

Title of each class of securities to be registered	Amount to be registered(1)	Proposed maximum offering price per unit(1)	Proposed maximum aggregate offering price(1)	Amount of registration fee
Common Stock, \$0.001 par value per share				(2)
Preferred Stock, \$0.001 par value per share				(2)
Depository Shares(3)				(2)
Units				(2)
Warrants				(2)
Total			\$250,000,000.00	\$24,560(2)

- (1) Pursuant to Form S-3 General Instruction II.D information is not required to be included. An indeterminate amount of the securities of each identified class is being registered as may from time to time be offered hereunder at indeterminate prices, along with an indeterminate number of securities that may be issued upon exercise, settlement, exchange or conversion of securities offered or sold hereunder or that are represented by depository shares as shall have an aggregate initial offering price not to exceed \$250,000,000¹. Pursuant to Rule 416 under the Securities Act of 1933, as amended (the "Securities Act"), this registration statement also covers any additional securities that may be offered or issued in connection with any stock split, stock dividend or pursuant to anti-dilution provisions of any of the securities. Separate consideration may or may not be received for securities that are issuable upon conversion, exercise or exchange of other securities. In addition, the total amount to be registered and the proposed maximum aggregate offering price are estimated solely for the purpose of calculating the registration fee pursuant to Rule 457(o) under the Securities Act.
- (2) Pursuant to Rule 415(a)(6) under the Securities Act, the securities registered pursuant to this registration statement include \$47,359,810 of unsold securities (the "Unsold Securities") previously registered for primary offerings in accordance with Rule 415(a)(1)(x) under the Securities Act ("Rule 415(a)(1)(x)") on the registrant's registration statement on Form S-3 (File No. 333-212382) filed on July 1, 2016 and declared effective on July 19, 2016 (the "Prior Registration Statement"). The Prior Registration Statement registered securities for primary offerings in accordance with Rule 415(a)(1)(x) with a proposed maximum aggregate offering price of \$100,000,000. The registrant sold an aggregate of \$52,640,190 of such securities under the Prior Registration Statement, leaving the balance of \$47,359,810 of Unsold Securities, in respect of which (i) the registration paid an aggregate registration fee of \$4,769.13 in connection with the Prior Registration Statement and (ii) no additional registration fee is due in connection with the filing of this registration statement. The registrant is also registering new securities (the "New Securities") pursuant to this registration statement with a proposed maximum aggregate offering price of \$202,640,190 and accordingly the registrant is paying a registration fee of \$24,560 in respect of the New Securities in connection with the filing of this registration statement. To the extent that, after the filing date of this registration statement and prior to the effectiveness of hereof, the registrant sells any Unsold Securities pursuant to the Prior Registration Statement, the registrant will identify in a pre-effective amendment to this registration statement the updated amount of Unsold Securities from the Prior Registration Statement to be included in this registration statement pursuant to Rule 415(a)(6) and the updated amount of New Securities to be registered pursuant to this registration statement. Pursuant to Rule 415(a)(6), the offering of the Unsold Securities under the Prior Registration Statement will be deemed terminated as of the time of effectiveness of this registration statement.
- (3) Each depository share will be issued under a deposit agreement, will represent an interest in a fractional share or multiple shares of preferred stock and will be evidenced by a depository receipt.

The Registrant hereby amends this Registration Statement on such date or dates as may be necessary to delay its effective date until the Registrant shall file a further amendment which specifically states that this Registration Statement shall thereafter become effective in accordance with Section 8(a) of the Securities Act of 1933 or until the Registration Statement shall become effective on such date as the Commission acting pursuant to said Section 8(a), may determine.

EXPLANATORY NOTE

This registration statement contains three prospectuses:

- a base prospectus which covers the offering, issuance and sale by us of up to \$250,000,000 of our common stock, preferred stock, depositary shares, units and warrants;
- a warrant share prospectus covering the offering, issuance and sale by us of up to 1,997,000 shares of our common stock that may be issued and sold upon the exercise of certain outstanding warrants for an aggregate exercise price of up to \$12,481,250; and
- a sales agreement prospectus covering the offering, issuance and sale by us of up to \$50,000,000 of our common stock that may be issued and sold under a sales agreement with Cowen and Company, LLC.

The base prospectus immediately follows this explanatory note. The specific terms of any securities to be offered pursuant to the base prospectus will be specified in a prospectus supplement to the base prospectus.

The warrant share prospectus immediately follows the base prospectus. The common stock that may be offered, issued and sold by us under the warrant share prospectus is included in the \$250,000,000 of securities that may be offered, issued and sold by us under the base prospectus. In the event of the termination of the offering of warrant shares under the warrant share prospectus, any portion of the \$12,481,250 aggregate exercise price for the warrant shares covered by the warrant share prospectus that is not sold pursuant to the warrant share prospectus will be available for sale in other offerings pursuant to the base prospectus.

The sales agreement prospectus immediately follows the warrant share prospectus. The common stock that may be offered, issued and sold by us under the sales agreement prospectus is included in the \$250,000,000 of securities that may be offered, issued and sold by us under the base prospectus. In the event of the termination of the offering of common stock under the sales agreement prospectus, any portion of the \$50,000,000 aggregate offering price for the common stock covered by the sales agreement prospectus that is not sold pursuant to the sales agreement prospectus will be available for sale in other offerings pursuant to the base prospectus.

The information in this prospectus is not complete and may be changed. We may not sell these securities until the registration statement filed with the Securities and Exchange Commission is effective. This prospectus is not an offer to sell these securities and we are not soliciting offers to buy these securities in any jurisdiction where the offer or sale is not permitted.

Subject to completion, dated May 14, 2019

PROSPECTUS

\$250,000,000

CATABASIS PHARMACEUTICALS, INC.

**Common Stock
Preferred Stock
Depositary Shares
Units
Warrants**

We may offer and sell securities from time to time in one or more offerings of up to \$250,000,000 in aggregate offering price. This prospectus describes the general terms of these securities and the general manner in which these securities will be offered. We will provide the specific terms of these securities in supplements to this prospectus. The prospectus supplements will also describe the specific manner in which these securities will be offered and may also supplement, update or amend information contained in this document. You should read this prospectus and any applicable prospectus supplement before you invest.

We may offer these securities in amounts, at prices and on terms determined at the time of offering. The securities may be sold directly to you, through agents, or through underwriters and dealers. If agents, underwriters or dealers are used to sell the securities, we will name them and describe their compensation in a prospectus supplement.

Our common stock is listed on The Nasdaq Global Select Market under the symbol "CATB".

Investing in these securities involves certain risks. See "Risk Factors" included in any accompanying prospectus supplement and in the documents incorporated by reference in this prospectus for a discussion of the factors you should carefully consider before deciding to purchase these securities.

Neither the Securities and Exchange Commission nor any state securities commission has approved or disapproved of these securities or passed upon the adequacy or accuracy of this prospectus. Any representation to the contrary is a criminal offense.

The date of this prospectus is _____, 2019

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ABOUT THIS PROSPECTUS

This prospectus is part of a registration statement that we filed with the Securities and Exchange Commission, which we refer to as the "SEC," utilizing a "shelf" registration process. Under this shelf registration process, we may from time to time sell any combination of the securities described in this prospectus in one or more offerings for an aggregate initial offering price of up to \$250,000,000.

This prospectus provides you with a general description of the securities we may offer. Each time we sell securities, we will provide one or more prospectus supplements that will contain specific information about the terms of the offering. The prospectus supplement may also add, update or change information contained in this prospectus. You should read both this prospectus and the accompanying prospectus supplement together with the additional information described under the heading "Where You Can Find More Information" beginning on page 2 of this prospectus.

You should rely only on the information contained in or incorporated by reference in this prospectus, any accompanying prospectus supplement or in any related free writing prospectus filed by us with the SEC. We have not authorized anyone to provide you with different information. This prospectus and any accompanying prospectus supplement do not constitute an offer to sell or the solicitation of an offer to buy any securities other than the securities described in this prospectus or such accompanying prospectus supplement or an offer to sell or the solicitation of an offer to buy such securities in any circumstances in which such offer or solicitation is unlawful. You should assume that the information appearing in this prospectus, any prospectus supplement, the documents incorporated by reference and any related free writing prospectus is accurate only as of their respective dates. Our business, financial condition, results of operations and prospects may have changed materially since those dates.

Unless the context otherwise indicates, references in this prospectus to "we," "our" and "us" refer, collectively, to Catabasis Pharmaceuticals, Inc., a Delaware corporation, and its consolidated subsidiary.

WHERE YOU CAN FIND MORE INFORMATION

We file annual, quarterly and current reports, proxy statements and other information with the SEC. Our SEC filings are available to the public over the Internet at the SEC's website at <http://www.sec.gov>. Copies of certain information filed by us with the SEC are also available on our website at www.catabasis.com. Our website is not a part of this prospectus and is not incorporated by reference in this prospectus.

This prospectus is part of a registration statement we filed with the SEC. This prospectus omits some information contained in the registration statement in accordance with SEC rules and regulations. You should review the information and exhibits in the registration statement for further information about us and our consolidated subsidiary and the securities we are offering. Statements in this prospectus concerning any document we filed as an exhibit to the registration statement or that we otherwise filed with the SEC are not intended to be comprehensive and are qualified by reference to these filings. You should review the complete document to evaluate these statements.

INCORPORATION BY REFERENCE

The SEC allows us to incorporate by reference much of the information we file with the SEC, which means that we can disclose important information to you by referring you to those publicly available documents. The information that we incorporate by reference in this prospectus is considered to be part of this prospectus. Because we are incorporating by reference future filings with the SEC, this prospectus is continually updated and those future filings may modify or supersede some of the information included or incorporated in this prospectus. This means that you must look at all of the SEC filings that we incorporate by reference to determine if any of the statements in this prospectus or in any document previously incorporated by reference have been modified or superseded. This prospectus incorporates by reference the documents listed below (File No. 001-37467) and any future filings we make with the SEC under Sections 13(a), 13(c), 14 or 15(d) of the Securities Exchange Act of 1934, as amended, or the Exchange Act (in each case, other than those documents or the portions of those documents not deemed to be filed) between the date of the initial registration statement and the effectiveness of the registration statement and following the effectiveness of the registration statement until the offering of the securities under the registration statement is terminated or completed:

- [Annual Report on Form 10-K for the fiscal year ended December 31, 2018](#), including the information specifically incorporated by reference into the Annual Report on Form 10-K from our [definitive proxy statement for the 2019 Annual Meeting of Stockholders](#);
- Quarterly Report on Form 10-Q for the quarterly period ended March 31, 2019;
- Current Reports on Form 8-K filed [January 9, 2019](#), [February 6, 2019](#), [February 14, 2019](#); and
- [The description of our common stock contained in our Registration Statement on Form 8-A filed on June 23, 2015, including any amendments or reports filed for the purpose of updating such description.](#)

You may request a copy of these filings, at no cost, by writing or telephoning us at the following address or telephone number:

Catabasis Pharmaceuticals, Inc.
One Kendall Square
Building 1400E, Suite B14202
Cambridge, MA 02139
Attn: Investor Relations
(617) 349-1971

FORWARD-LOOKING STATEMENTS

This prospectus and the information incorporated by reference in this prospectus include "forward-looking statements" within the meaning of Section 27A of the Securities Act of 1933, as amended, or the Securities Act, and Section 21E of the Exchange Act. All statements, other than statements of historical facts, contained or incorporated by reference in this prospectus, including statements regarding our strategy, future operations, future financial position, future revenue, projected costs, prospects, plans and objectives of management and expected market growth are forward-looking statements. The words "anticipate," "believe," "continue," "could," "estimate," "expect," "intend," "may," "plan," "potential," "predict," "project," "should," "target," "would" and similar expressions are intended to identify forward-looking statements, although not all forward-looking statements contain these identifying words.

These forward-looking statements include, among other things, statements about:

- our expectations regarding our ability to successfully conduct the PolarisDMD trial, and our expectations regarding the timing and results of such trial, including reporting top-line results of this trial in the second half of 2020 and the potential consistency of data produced by this trial with prior results from our MoveDMD® trial, as well as any new data and analyses relating to the safety profile and potential clinical benefits of edasalonexent;
- our expectations regarding our ability to successfully conduct the GalaxyDMD open-label extension trial, including the anticipated announcement of data from this trial;
- our plans to identify, develop and commercialize novel therapeutics based on our SMART Linker™ drug discovery platform;
- ongoing and planned clinical trials for edasalonexent and other product candidates, whether conducted by us or by any future collaborators, including the timing of initiation of these trials and the anticipated announcement of results;
- our plans to enter into collaborations for the development and commercialization of product candidates;
- the potential benefits of any future collaboration;
- our ability to receive research and development funding and achieve anticipated milestones under any future collaborations;
- the timing of and our ability to obtain and maintain regulatory approvals for our product candidates;
- the rate and degree of market acceptance and clinical utility of any products for which we receive marketing approval;
- our commercialization, marketing and manufacturing capabilities and strategy;
- our intellectual property position and strategy;
- our ability to identify additional products or product candidates with significant commercial potential;
- our estimates regarding expenses, future revenue, capital requirements and needs for additional financing;
- developments relating to our competitors and our industry; and
- the impact of government laws and regulations.

You are cautioned that these forward-looking statements are only predictions and are subject to risks, uncertainties and assumptions that are referenced in the section of any accompanying prospectus supplement entitled "Risk Factors." You should also carefully review the risk factors and cautionary statements described in the other documents we file from time to time with the SEC, specifically our most recent Annual Report on Form 10-K, our Quarterly Reports on Form 10-Q and our Current Reports on Form 8-K. We undertake no obligation to revise or update any forward-looking statements, except to the extent required by law.

CATABASIS PHARMACEUTICALS, INC.

We are a clinical-stage biopharmaceutical company focused on the discovery, development and commercialization of novel therapeutics. Our lead product candidate is edasalonexent, formerly known as CAT-1004, an oral small molecule that inhibits NF- κ B, or nuclear factor kappa-light-chain-enhancer of activated B cells, in development for the treatment of Duchenne muscular dystrophy, or DMD. We believe edasalonexent has the potential to be a foundational therapy for all patients affected by DMD regardless of the underlying dystrophin mutation. DMD is an ultimately fatal genetic disorder involving progressive muscle degeneration. The United States Food and Drug Administration has granted orphan drug, fast track and rare pediatric disease designations to edasalonexent for the treatment of DMD. The European Commission has granted orphan medicinal product designation to edasalonexent for the treatment of DMD.

Our principal executive offices are located at One Kendall Square, Building 1400E, Suite B14202, Cambridge, Massachusetts 02139, and our telephone number is (617) 349-1971.

USE OF PROCEEDS

We intend to use the net proceeds from the sale of any securities offered under this prospectus for general corporate purposes unless otherwise indicated in the applicable prospectus supplement. General corporate purposes may include research and development expenditures, repayment and refinancing of debt, working capital and capital expenditures. We have not determined the amount of net proceeds to be used specifically for such purposes. As a result, management will retain broad discretion over the allocation of net proceeds.

DESCRIPTION OF CAPITAL STOCK

The following description of our capital stock is intended as a summary only and therefore is not a complete description of our capital stock. This description is based upon, and is qualified by reference to, our certificate of incorporation, our by-laws and applicable provisions of Delaware corporate law. You should read our certificate of incorporation and by-laws, which are filed as exhibits to the registration statement of which this prospectus forms a part, for the provisions that are important to you.

Our authorized capital stock consists of 150,000,000 shares of common stock, \$0.001 par value per share, and 5,000,000 shares of preferred stock, \$0.001 par value per share. As of March 31, 2019, 11,496,242 shares of common stock were outstanding and no shares of preferred stock were outstanding.

Common Stock

Voting Rights. Holders of our common stock are entitled to one vote for each share held on all matters submitted to a vote of stockholders, except that unless otherwise required by law, holders of our common stock are not entitled to vote on any amendment to the certificate of incorporation that relates solely to the terms of one or more outstanding series of preferred stock, if the holders of such affected series are entitled, either separately or together as a class with the holders of one or more such other series, to vote thereon pursuant to the certificate of incorporation. Holders of our common stock do not have cumulative voting rights.

An election of directors will be decided by a plurality of the votes cast by the stockholders entitled to vote on the election at a duly held stockholders' meeting at which a quorum is present. All other questions will be decided by a majority of the votes cast by stockholders entitled to vote thereon at a duly held meeting of stockholders at which a quorum is present, except when a different vote is required by law, our certificate of incorporation or by-laws.

Dividends. Holders of common stock are entitled to receive proportionately any dividends as may be declared by our board of directors, subject to any preferential dividend or other rights of any series of preferred stock that we may designate and issue in the future.

Liquidation and Dissolution. In the event of our liquidation or dissolution, the holders of common stock are entitled to receive proportionately our net assets available for distribution to stockholders after the payment of all debts and other liabilities and subject to the prior rights of any outstanding preferred stock.

Other Rights. Holders of common stock have no preemptive, subscription, redemption or conversion rights. The rights, preferences and privileges of holders of common stock are subject to and may be adversely affected by the rights of the holders of shares of any series of preferred stock that we may designate and issue in the future.

Transfer Agent and Registrar. The transfer agent and registrar for our common stock is American Stock Transfer & Trust Company, LLC.

Listing on The Nasdaq Global Market. Our common stock is listed on The Nasdaq Global Market under the symbol "CATB."

Preferred Stock

We currently have no outstanding shares of preferred stock. Under our restated certificate of incorporation, we are authorized to issue "blank check" preferred stock, which may be issued in one or more series upon authorization of our board of directors. Our board of directors is authorized to fix

the designation of the series, the number of authorized shares of the series, dividend rights and terms, conversion rights, voting rights, redemption rights and terms, liquidation preferences and any other rights, powers, preferences and limitations applicable to each series of preferred stock. The authorized shares of our preferred stock are available for issuance without further action by our stockholders, unless such action is required by applicable law or the rules of any stock exchange on which our securities may be listed. If the approval of our stockholders is not required for the issuance of shares of our preferred stock, our board may determine not to seek stockholder approval. The specific terms of any series of preferred stock offered pursuant to this prospectus will be described in the prospectus supplement relating to that series of preferred stock.

A series of our preferred stock could, depending on the terms of such series, impede the completion of a merger, tender offer or other takeover attempt. Our board of directors will make any determination to issue preferred shares based upon its judgment as to the best interests of our stockholders. Our directors, in so acting, could issue preferred stock having terms that could discourage an acquisition attempt through which an acquirer may be able to change the composition of our board of directors, including a tender offer or other transaction that some, or a majority, of our stockholders might believe to be in their best interests or in which stockholders might receive a premium for their stock over the then-current market price of the stock.

The preferred stock has the terms described below unless otherwise provided in the prospectus supplement relating to a particular series of preferred stock. You should read the prospectus supplement relating to the particular series of preferred stock being offered for specific terms, including:

- the designation and stated value per share of the preferred stock and the number of shares offered;
- the amount of liquidation preference per share;
- the price at which the preferred stock will be issued;
- the dividend rate, or method of calculation of dividends, the dates on which dividends will be payable, whether dividends will be cumulative or noncumulative and, if cumulative, the dates from which dividends will commence to accumulate;
- any redemption or sinking fund provisions;
- if other than the currency of the United States, the currency or currencies including composite currencies in which the preferred stock is denominated and/or in which payments will or may be payable;
- any conversion provisions;
- whether we have elected to offer depositary shares as described under "Description of Depositary Shares"; and
- any other rights, preferences, privileges, limitations and restrictions on the preferred stock.

The preferred stock will, when issued, be fully paid and non-assessable. Unless otherwise specified in the prospectus supplement, each series of preferred stock will rank equally as to dividends and liquidation rights in all respects with each other series of preferred stock. The rights of holders of shares of each series of preferred stock will be subordinate to those of our general creditors.

As described under "Description of Depositary Shares," we may, at our option, with respect to any series of preferred stock, elect to offer fractional interests in shares of preferred stock, and provide for the issuance of depositary receipts representing depositary shares, each of which will represent a

fractional interest in a share of the series of preferred stock. The fractional interest will be specified in the prospectus supplement relating to a particular series of preferred stock.

Rank. Unless otherwise specified in the prospectus supplement, the preferred stock will, with respect to dividend rights and rights upon our liquidation, dissolution or winding up of our affairs, rank:

- senior to our common stock and to all equity securities ranking junior to such preferred stock with respect to dividend rights or rights upon our liquidation, dissolution or winding up of our affairs;
- on a parity with all equity securities issued by us, the terms of which specifically provide that such equity securities rank on a parity with the preferred stock with respect to dividend rights or rights upon our liquidation, dissolution or winding up of our affairs; and
- junior to all equity securities issued by us, the terms of which specifically provide that such equity securities rank senior to the preferred stock with respect to dividend rights or rights upon our liquidation, dissolution or winding up of our affairs.

The term "equity securities" does not include convertible debt securities.

Dividends. Holders of the preferred stock of each series will be entitled to receive, when, as and if declared by our board of directors, cash dividends at such rates and on such dates described in the prospectus supplement. Different series of preferred stock may be entitled to dividends at different rates or based on different methods of calculation. The dividend rate may be fixed or variable or both. Dividends will be payable to the holders of record as they appear on our stock books on record dates fixed by our board of directors, as specified in the applicable prospectus supplement.

Dividends on any series of preferred stock may be cumulative or noncumulative, as described in the applicable prospectus supplement. If our board of directors does not declare a dividend payable on a dividend payment date on any series of noncumulative preferred stock, then the holders of that noncumulative preferred stock will have no right to receive a dividend for that dividend payment date, and we will have no obligation to pay the dividend accrued for that period, whether or not dividends on that series are declared payable on any future dividend payment dates. Dividends on any series of cumulative preferred stock will accrue from the date we initially issue shares of such series or such other date specified in the applicable prospectus supplement.

No dividends may be declared or paid or funds set apart for the payment of any dividends on any parity securities unless full dividends have been paid or set apart for payment on the preferred stock. If full dividends are not paid, the preferred stock will share dividends pro rata with the parity securities.

No dividends may be declared or paid or funds set apart for the payment of dividends on any junior securities unless full dividends for all dividend periods terminating on or prior to the date of the declaration or payment will have been paid or declared and a sum sufficient for the payment set apart for payment on the preferred stock.

Liquidation Preference. Upon any voluntary or involuntary liquidation, dissolution or winding up of our affairs, then, before we make any distribution or payment to the holders of any common stock or any other class or series of our capital stock ranking junior to the preferred stock in the distribution of assets upon any liquidation, dissolution or winding up of our affairs, the holders of each series of preferred stock shall be entitled to receive out of assets legally available for distribution to stockholders, liquidating distributions in the amount of the liquidation preference per share set forth in the prospectus supplement, plus any accrued and unpaid dividends thereon. Such dividends will not include any accumulation in respect of unpaid noncumulative dividends for prior dividend periods. Unless otherwise specified in the prospectus supplement, after payment of the full amount of their

liquidating distributions, the holders of preferred stock will have no right or claim to any of our remaining assets. Upon any such voluntary or involuntary liquidation, dissolution or winding up, if our available assets are insufficient to pay the amount of the liquidating distributions on all outstanding preferred stock and the corresponding amounts payable on all other classes or series of our capital stock ranking on parity with the preferred stock and all other such classes or series of shares of capital stock ranking on parity with the preferred stock in the distribution of assets, then the holders of the preferred stock and all other such classes or series of capital stock will share ratably in any such distribution of assets in proportion to the full liquidating distributions to which they would otherwise be entitled.

Upon any such liquidation, dissolution or winding up and if we have made liquidating distributions in full to all holders of preferred stock, we will distribute our remaining assets among the holders of any other classes or series of capital stock ranking junior to the preferred stock according to their respective rights and preferences and, in each case, according to their respective number of shares. For such purposes, our consolidation or merger with or into any other corporation, trust or entity, or the sale, lease or conveyance of all or substantially all of our property or assets will not be deemed to constitute a liquidation, dissolution or winding up of our affairs.

Redemption. If so provided in the applicable prospectus supplement, the preferred stock will be subject to mandatory redemption or redemption at our option, as a whole or in part, in each case upon the terms, at the times and at the redemption prices set forth in such prospectus supplement.

The prospectus supplement relating to a series of preferred stock that is subject to mandatory redemption will specify the number of shares of preferred stock that shall be redeemed by us in each year commencing after a date to be specified, at a redemption price per share to be specified, together with an amount equal to all accrued and unpaid dividends thereon to the date of redemption. Unless the shares have a cumulative dividend, such accrued dividends will not include any accumulation in respect of unpaid dividends for prior dividend periods. We may pay the redemption price in cash or other property, as specified in the applicable prospectus supplement. If the redemption price for preferred stock of any series is payable only from the net proceeds of the issuance of shares of our capital stock, the terms of such preferred stock may provide that, if no such shares of our capital stock shall have been issued or to the extent the net proceeds from any issuance are insufficient to pay in full the aggregate redemption price then due, such preferred stock shall automatically and mandatorily be converted into the applicable shares of our capital stock pursuant to conversion provisions specified in the applicable prospectus supplement. Notwithstanding the foregoing, we will not redeem any preferred stock of a series unless:

- if that series of preferred stock has a cumulative dividend, we have declared and paid or contemporaneously declare and pay or set aside funds to pay full cumulative dividends on the preferred stock for all past dividend periods and the then current dividend period; or
- if such series of preferred stock does not have a cumulative dividend, we have declared and paid or contemporaneously declare and pay or set aside funds to pay full dividends for the then current dividend period.

In addition, we will not acquire any preferred stock of a series unless:

- if that series of preferred stock has a cumulative dividend, we have declared and paid or contemporaneously declare and pay or set aside funds to pay full cumulative dividends on all outstanding shares of such series of preferred stock for all past dividend periods and the then current dividend period; or
- if that series of preferred stock does not have a cumulative dividend, we have declared and paid or contemporaneously declare and pay or set aside funds to pay full dividends on the preferred stock of such series for the then current dividend period.

However, at any time we may purchase or acquire preferred stock of that series (1) pursuant to a purchase or exchange offer made on the same terms to holders of all outstanding preferred stock of such series or (2) by conversion into or exchange for shares of our capital stock ranking junior to the preferred stock of such series as to dividends and upon liquidation.

If fewer than all of the outstanding shares of preferred stock of any series are to be redeemed, we will determine the number of shares that may be redeemed pro rata from the holders of record of such shares in proportion to the number of such shares held or for which redemption is requested by such holder or by any other equitable manner that we determine. Such determination will reflect adjustments to avoid redemption of fractional shares.

Unless otherwise specified in the prospectus supplement, we will mail notice of redemption at least 30 days but not more than 60 days before the redemption date to each holder of record of preferred stock to be redeemed at the address shown on our stock transfer books. Each notice shall state:

- the redemption date;
- the number of shares and series of preferred stock to be redeemed;
- the redemption price;
- the place or places where certificates for such preferred stock are to be surrendered for payment of the redemption price;
- that dividends on the shares to be redeemed will cease to accrue on such redemption date;
- the date on which the holder's conversion rights, if any, as to such shares shall terminate; and
- the specific number of shares to be redeemed from each such holder if fewer than all the shares of any series are to be redeemed.

If notice of redemption has been given and we have set aside the funds necessary for such redemption in trust for the benefit of the holders of any shares called for redemption, then from and after the redemption date, dividends will cease to accrue on such shares, and all rights of the holders of such shares will terminate, except the right to receive the redemption price.

Voting Rights. Holders of preferred stock will not have any voting rights, except as required by law or as indicated in the applicable prospectus supplement.

Unless otherwise provided for under the terms of any series of preferred stock, no consent or vote of the holders of shares of preferred stock or any series thereof shall be required for any amendment to our certificate of incorporation that would increase the number of authorized shares of preferred stock or the number of authorized shares of any series thereof or decrease the number of authorized shares of preferred stock or the number of authorized shares of any series thereof (but not below the number of authorized shares of preferred stock or such series, as the case may be, then outstanding).

Conversion Rights. The terms and conditions, if any, upon which any series of preferred stock is convertible into our common stock will be set forth in the applicable prospectus supplement relating thereto. Such terms will include the number of shares of common stock into which the shares of preferred stock are convertible, the conversion price, rate or manner of calculation thereof, the conversion period, provisions as to whether conversion will be at our option or at the option of the holders of the preferred stock, the events requiring an adjustment of the conversion price and provisions affecting conversion in the event of the redemption.

Transfer Agent and Registrar. The transfer agent and registrar for the preferred stock will be set forth in the applicable prospectus supplement.

Provisions of Our Certificate of Incorporation and By-laws and Delaware Law That May Have Anti-Takeover Effects

Delaware law, our certificate of incorporation and our by-laws contain provisions that could have the effect of delaying, deferring or discouraging another party from acquiring control of us. These provisions, which are summarized below, are expected to discourage coercive takeover practices and inadequate takeover bids. These provisions are also designed to encourage persons seeking to acquire control of us to first negotiate with our board of directors.

Staggered Board; Removal of Directors. Our certificate of incorporation and by-laws divide our board of directors into three classes with staggered three-year terms. In addition, a director is only able to be removed for cause and only by the affirmative vote of the holders of at least 75% of the votes that all of our stockholders would be entitled to cast in an annual election of directors. Any vacancy on our board of directors, including a vacancy resulting from an enlargement of our board of directors, is only able to be filled by vote of a majority of our directors then in office. The classification of our board of directors and the limitations on the removal of directors and filling of vacancies could make it more difficult for a third party to acquire, or discourage a third party from seeking to acquire, control of our company.

Stockholder Action by Written Consent; Special Meetings. Our certificate of incorporation provides that any action required or permitted to be taken by our stockholders must be effected at a duly called annual or special meeting of our stockholders and may not be effected by any consent in writing by our stockholders. Our certificate of incorporation and by-laws also provide that, except as otherwise required by law, special meetings of our stockholders can only be called by our chairman of the board, our chief executive officer or our board of directors.

Advance Notice Requirements for Stockholder Proposals. Our by-laws establish an advance notice procedure for stockholder proposals to be brought before an annual meeting of stockholders, including proposed nominations of persons for election to our board of directors. Stockholders at an annual meeting are only able to consider proposals or nominations specified in the notice of meeting or brought before the meeting by or at the direction of our board of directors or by a stockholder of record on the record date for the meeting who is entitled to vote at the meeting and who has delivered timely written notice in proper form to our secretary of the stockholder's intention to bring such business before the meeting. These provisions could have the effect of delaying until the next stockholder meeting stockholder actions that are favored by the holders of a majority of our outstanding voting securities.

Delaware Business Combination Statute. We are subject to Section 203 of the General Corporation Law of the State of Delaware. Subject to certain exceptions, Section 203 prevents a publicly held Delaware corporation from engaging in a "business combination" with any "interested stockholder" for three years following the date that the person became an interested stockholder, unless the interested stockholder attained such status with the approval of our board of directors or unless the business combination is approved in a prescribed manner. A "business combination" includes, among other things, a merger or consolidation involving us and the "interested stockholder" and the sale of more than 10% of our assets. In general, an "interested stockholder" is any entity or person beneficially owning 15% or more of our outstanding voting stock and any entity or person affiliated with or controlling or controlled by such entity or person.

Amendment of Certificate of Incorporation and By-laws. The General Corporation Law of the State of Delaware provides generally that the affirmative vote of a majority of the shares entitled to vote on any matter is required to amend a corporation's certificate of incorporation or by-laws, unless a corporation's certificate of incorporation or by-laws, as the case may be, requires a greater percentage. Our by-laws may be amended or repealed by a majority vote of our board of directors or by the

affirmative vote of the holders of at least 75% of the votes that all of our stockholders would be entitled to cast in any annual election of directors. In addition, the affirmative vote of the holders of at least 75% of the votes that all of our stockholders would be entitled to cast in any annual election of directors is required to amend or repeal or to adopt any provisions inconsistent with any of the provisions of our certificate of incorporation described above under "*—Staggered Board; Removal of Directors*" and "*—Stockholder Action by Written Consent; Special Meetings*."

Exclusive Forum Selection. Our certificate of incorporation provides that, unless we consent in writing to the selection of an alternative forum, the Court of Chancery of the State of Delaware (or if the Court of Chancery does not have jurisdiction, the federal district court for the District of Delaware) shall be the sole and exclusive forum for (1) any derivative action or proceeding brought on behalf of our company, (2) any action asserting a claim of breach of a fiduciary duty owed by any of our directors, officers or employees to our company or our stockholders, (3) any action asserting a claim against our company arising pursuant to any provision of the General Corporation Law of the State of Delaware or our certificate of incorporation or by-laws, or (4) any action asserting a claim against our company governed by the internal affairs doctrine. Although our certificate of incorporation contains the choice of forum provision described above, it is possible that a court could rule that such a provision is inapplicable for a particular claim or action or that such provision is unenforceable.

Authorized but Unissued Shares. Our authorized but unissued shares of common stock and preferred stock are available for future issuance without stockholder approval, subject to any limitations imposed by the listing requirements of the Nasdaq Global Market. These additional shares may be used for a variety of corporate finance transactions, acquisitions and employee benefit plans. The existence of authorized but unissued and unreserved common stock and preferred stock could make it more difficult or discourage an attempt to obtain control of us by means of a proxy contest, tender offer, merger or otherwise.

DESCRIPTION OF DEPOSITARY SHARES

General

We may, at our option, elect to offer fractional shares of preferred stock, which we call depositary shares, rather than full shares of preferred stock. If we do, we will issue to the public receipts, called depositary receipts, for depositary shares, each of which will represent a fraction, to be described in the applicable prospectus supplement, of a share of a particular series of preferred stock. Unless otherwise provided in the prospectus supplement, each owner of a depositary share will be entitled, in proportion to the applicable fractional interest in a share of preferred stock represented by the depositary share, to all the rights and preferences of the preferred stock represented by the depositary share. Those rights include dividend, voting, redemption, conversion and liquidation rights.

The shares of preferred stock underlying the depositary shares will be deposited with a bank or trust company selected by us to act as depositary under a deposit agreement between us, the depositary and the holders of the depositary receipts. The depositary will be the transfer agent, registrar and dividend disbursing agent for the depositary shares.

The depositary shares will be evidenced by depositary receipts issued pursuant to the deposit agreement. Holders of depositary receipts agree to be bound by the deposit agreement, which requires holders to take certain actions such as filing proof of residence and paying certain charges.

The summary of terms of the depositary shares contained in this prospectus is not a complete description of the terms of the depositary shares. You should refer to the form of the deposit agreement, our certificate of incorporation and the certificate of designation for the applicable series of preferred stock that are, or will be, filed with the SEC.

Dividends and Other Distributions

The depositary will distribute all cash dividends or other cash distributions, if any, received in respect of the preferred stock underlying the depositary shares to the record holders of depositary shares in proportion to the numbers of depositary shares owned by those holders on the relevant record date. The relevant record date for depositary shares will be the same date as the record date for the underlying preferred stock.

If there is a distribution other than in cash, the depositary will distribute property (including securities) received by it to the record holders of depositary shares, unless the depositary determines that it is not feasible to make the distribution. If this occurs, the depositary may, with our approval, adopt another method for the distribution, including selling the property and distributing the net proceeds from the sale to the holders.

Liquidation Preference

If a series of preferred stock underlying the depositary shares has a liquidation preference, in the event of the voluntary or involuntary liquidation, dissolution or winding up of us, holders of depositary shares will be entitled to receive the fraction of the liquidation preference accorded each share of the applicable series of preferred stock, as set forth in the applicable prospectus supplement.

Withdrawal of Stock

Unless the related depositary shares have been previously called for redemption, upon surrender of the depositary receipts at the office of the depositary, the holder of the depositary shares will be entitled to delivery, at the office of the depositary to or upon his or her order, of the number of whole shares of the preferred stock and any money or other property represented by the depositary shares. If the depositary receipts delivered by the holder evidence a number of depositary shares in excess of the

number of depositary shares representing the number of whole shares of preferred stock to be withdrawn, the depositary will deliver to the holder at the same time a new depositary receipt evidencing the excess number of depositary shares. In no event will the depositary deliver fractional shares of preferred stock upon surrender of depositary receipts. Holders of preferred stock thus withdrawn may not thereafter deposit those shares under the deposit agreement or receive depositary receipts evidencing depositary shares therefor.

Redemption of Depositary Shares

Whenever we redeem shares of preferred stock held by the depositary, the depositary will redeem as of the same redemption date the number of depositary shares representing shares of the preferred stock so redeemed, so long as we have paid in full to the depositary the redemption price of the preferred stock to be redeemed plus an amount equal to any accumulated and unpaid dividends on the preferred stock to the date fixed for redemption. The redemption price per depositary share will be equal to the redemption price and any other amounts per share payable on the preferred stock multiplied by the fraction of a share of preferred stock represented by one depositary share. If less than all the depositary shares are to be redeemed, the depositary shares to be redeemed will be selected by lot or pro rata or by any other equitable method as may be determined by the depositary.

After the date fixed for redemption, depositary shares called for redemption will no longer be deemed to be outstanding and all rights of the holders of depositary shares will cease, except the right to receive the monies payable upon redemption and any money or other property to which the holders of the depositary shares were entitled upon redemption upon surrender to the depositary of the depositary receipts evidencing the depositary shares.

Voting the Preferred Stock

Upon receipt of notice of any meeting at which the holders of the preferred stock are entitled to vote, the depositary will mail the information contained in the notice of meeting to the record holders of the depositary receipts relating to that preferred stock. The record date for the depositary receipts relating to the preferred stock will be the same date as the record date for the preferred stock. Each record holder of the depositary shares on the record date will be entitled to instruct the depositary as to the exercise of the voting rights pertaining to the number of shares of preferred stock represented by that holder's depositary shares. The depositary will endeavor, insofar as practicable, to vote the number of shares of preferred stock represented by the depositary shares in accordance with those instructions, and we will agree to take all action that may be deemed necessary by the depositary in order to enable the depositary to do so. The depositary will not vote any shares of preferred stock except to the extent it receives specific instructions from the holders of depositary shares representing that number of shares of preferred stock.

Charges of Depositary

We will pay all transfer and other taxes and governmental charges arising solely from the existence of the depositary arrangements. We will pay charges of the depositary in connection with the initial deposit of the preferred stock and any redemption of the preferred stock. Holders of depositary receipts will pay transfer, income and other taxes and governmental charges and such other charges (including those in connection with the receipt and distribution of dividends, the sale or exercise of rights, the withdrawal of the preferred stock and the transferring, splitting or grouping of depositary receipts) as are expressly provided in the deposit agreement to be for their accounts. If these charges have not been paid by the holders of depositary receipts, the depositary may refuse to transfer depositary shares, withhold dividends and distributions and sell the depositary shares evidenced by the depositary receipt.

Amendment and Termination of the Deposit Agreement

The form of depositary receipt evidencing the depositary shares and any provision of the deposit agreement may be amended by agreement between us and the depositary. However, any amendment that materially and adversely alters the rights of the holders of depositary shares, other than fee changes, will not be effective unless the amendment has been approved by the holders of a majority of the outstanding depositary shares. The deposit agreement may be terminated by the depositary or us only if:

- all outstanding depositary shares have been redeemed; or
- there has been a final distribution of the preferred stock in connection with our dissolution and such distribution has been made to all the holders of depositary shares.

Resignation and Removal of Depositary

The depositary may resign at any time by delivering to us notice of its election to do so, and we may remove the depositary at any time. Any resignation or removal of the depositary will take effect upon our appointment of a successor depositary and its acceptance of such appointment. The successor depositary must be appointed within 60 days after delivery of the notice of resignation or removal and must be a bank or trust company having its principal office in the United States and having the requisite combined capital and surplus as set forth in the applicable agreement.

Notices

The depositary will forward to holders of depositary receipts all notices, reports and other communications, including proxy solicitation materials received from us, that are delivered to the depositary and that we are required to furnish to the holders of the preferred stock. In addition, the depositary will make available for inspection by holders of depositary receipts at the principal office of the depositary, and at such other places as it may from time to time deem advisable, any reports and communications we deliver to the depositary as the holder of preferred stock.

Limitation of Liability

Neither we nor the depositary will be liable if either we or it is prevented or delayed by law or any circumstance beyond its control in performing its obligations. Our obligations and those of the depositary will be limited to performance in good faith of our and their duties thereunder. We and the depositary will not be obligated to prosecute or defend any legal proceeding in respect of any depositary shares or preferred stock unless satisfactory indemnity is furnished. We and the depositary may rely upon written advice of counsel or accountants, on information provided by persons presenting preferred stock for deposit, holders of depositary receipts or other persons believed to be competent to give such information and on documents believed to be genuine and to have been signed or presented by the proper party or parties.

DESCRIPTION OF UNITS

We may issue units comprised of one or more of the other securities that may be offered under this prospectus, in any combination. The following, together with the additional information we may include in the applicable prospectus supplement, summarizes the material terms and provisions of the units that we may offer under this prospectus. While the terms summarized below will apply generally to any units we may offer, we will describe the particular terms of any series of units in more detail in the applicable prospectus supplement.

Each unit will be issued so that the holder of the unit is also the holder of each security included in the unit. Thus, the holder of a unit will have the rights and obligations of a holder of each included security. The unit agreement under which a unit is issued may provide that the securities included in the unit may not be held or transferred separately at any time, or at any time before a specified date.

Any applicable prospectus supplement will describe:

- the material terms of the units and of the securities comprising the units, including whether and under what circumstances those securities may be held or transferred separately;
- any material provisions relating to the issuance, payment, settlement, transfer or exchange of the units or of the securities comprising the units; and
- any material provisions of the governing unit agreement that differ from those described above.

DESCRIPTION OF WARRANTS

We may issue warrants to purchase common stock, preferred stock or depositary shares. We may offer warrants separately or together with one or more additional warrants, common stock, preferred stock or depositary shares, or any combination of those securities in the form of units, as described in the applicable prospectus supplement. If we issue warrants as part of a unit, the accompanying prospectus supplement will specify whether those warrants may be separated from the other securities in the unit prior to the expiration date of the warrants. The applicable prospectus supplement will also describe the following terms of any warrants:

- the specific designation and aggregate number of, and the offering price at which we will issue, the warrants;
- the currency or currency units in which the offering price, if any, and the exercise price are payable;
- the date on which the right to exercise the warrants will begin and the date on which that right will expire or, if you may not continuously exercise the warrants throughout that period, the specific date or dates on which you may exercise the warrants;
- whether the warrants are to be sold separately or with other securities as parts of units;
- whether the warrants will be issued in definitive or global form or in any combination of these forms, although, in any case, the form of a warrant included in a unit will correspond to the form of the unit and of any security included in that unit;
- any applicable material U.S. federal income tax consequences;
- the identity of the warrant agent for the warrants and of any other depositaries, execution or paying agents, transfer agents, registrars or other agents;
- the proposed listing, if any, of the warrants or any securities purchasable upon exercise of the warrants on any securities exchange;
- the designation and terms of any equity securities purchasable upon exercise of the warrants;
- if applicable, the designation and terms of the preferred stock or depositary shares with which the warrants are issued and the number of warrants issued with each security;
- if applicable, the date from and after which any warrants issued as part of a unit and the related preferred stock, depositary shares or common stock will be separately transferable;
- the number of shares of common stock, preferred stock or depositary shares purchasable upon exercise of a warrant and the price at which those shares may be purchased;
- if applicable, the minimum or maximum amount of the warrants that may be exercised at any one time;
- information with respect to book-entry procedures, if any;
- the anti-dilution provisions of, and other provisions for changes to or adjustment in the exercise price of, the warrants, if any;
- any redemption or call provisions; and
- any additional terms of the warrants, including terms, procedures and limitations relating to the exchange or exercise of the warrants.

FORMS OF SECURITIES

Each depositary share, unit and warrant will be represented either by a certificate issued in definitive form to a particular investor or by one or more global securities representing the entire issuance of securities. Unless the applicable prospectus supplement provides otherwise, certificated securities in definitive form and global securities will be issued in registered form. Definitive securities name you or your nominee as the owner of the security, and in order to transfer or exchange these securities or to receive payments other than interest or other interim payments, you or your nominee must physically deliver the securities to the trustee, registrar, paying agent or other agent, as applicable. Global securities name a depositary or its nominee as the owner of the depositary shares, units or warrants represented by these global securities. The depositary maintains a computerized system that will reflect each investor's beneficial ownership of the securities through an account maintained by the investor with its broker/dealer, bank, trust company or other representative, as we explain more fully below.

Global Securities

We may issue the depositary shares, units and warrants in the form of one or more fully registered global securities that will be deposited with a depositary or its nominee identified in the applicable prospectus supplement and registered in the name of that depositary or nominee. In those cases, one or more global securities will be issued in a denomination or aggregate denominations equal to the portion of the aggregate principal or face amount of the securities to be represented by global securities. Unless and until it is exchanged in whole for securities in definitive registered form, a global security may not be transferred except as a whole by and among the depositary for the global security, the nominees of the depositary or any successors of the depositary or those nominees.

If not described below, any specific terms of the depositary arrangement with respect to any securities to be represented by a global security will be described in the prospectus supplement relating to those securities. We anticipate that the following provisions will apply to all depositary arrangements.

Ownership of beneficial interests in a global security will be limited to persons, called participants, that have accounts with the depositary or persons that may hold interests through participants. Upon the issuance of a global security, the depositary will credit, on its book-entry registration and transfer system, the participants' accounts with the respective principal or face amounts of the securities beneficially owned by the participants. Any dealers, underwriters or agents participating in the distribution of the securities will designate the accounts to be credited. Ownership of beneficial interests in a global security will be shown on, and the transfer of ownership interests will be effected only through, records maintained by the depositary, with respect to interests of participants, and on the records of participants, with respect to interests of persons holding through participants. The laws of some states may require that some purchasers of securities take physical delivery of these securities in definitive form. These laws may impair your ability to own, transfer or pledge beneficial interests in global securities.

So long as the depositary, or its nominee, is the registered owner of a global security, that depositary or its nominee, as the case may be, will be considered the sole owner or holder of the securities represented by the global security for all purposes under the applicable deposit agreement, unit agreement or warrant agreement. Except as described below, owners of beneficial interests in a global security will not be entitled to have the securities represented by the global security registered in their names, will not receive or be entitled to receive physical delivery of the securities in definitive form and will not be considered the owners or holders of the securities under the applicable deposit agreement, unit agreement or warrant agreement. Accordingly, each person owning a beneficial interest in a global security must rely on the procedures of the depositary for that global security and, if that person is not a participant, on the procedures of the participant through which the person owns its

interest, to exercise any rights of a holder under the applicable deposit agreement, unit agreement or warrant agreement. We understand that under existing industry practices, if we request any action of holders or if an owner of a beneficial interest in a global security desires to give or take any action that a holder is entitled to give or take under the applicable deposit agreement, unit agreement or warrant agreement, the depository for the global security would authorize the participants holding the relevant beneficial interests to give or take that action, and the participants would authorize beneficial owners owning through them to give or take that action or would otherwise act upon the instructions of beneficial owners holding through them.

Any payments to holders with respect to depository shares, units or warrants represented by a global security registered in the name of a depository or its nominee will be made to the depository or its nominee, as the case may be, as the registered owner of the global security. None of us, or any warrant agent, unit agent or other agent of ours, or any agent of any warrant agent or unit agent will have any responsibility or liability for any aspect of the records relating to payments made on account of beneficial ownership interests in the global security or for maintaining, supervising or reviewing any records relating to those beneficial ownership interests.

We expect that the depository for any of the securities represented by a global security, upon receipt of any payment to holders or other distribution of underlying securities or other property on that registered global security, will immediately credit participants' accounts in amounts proportionate to their respective beneficial interests in that global security as shown on the records of the depository. We also expect that payments by participants to owners of beneficial interests in a global security held through participants will be governed by standing customer instructions and customary practices, as is now the case with the securities held for the accounts of customers or registered in "street name," and will be the responsibility of those participants.

If the depository for any of the securities represented by a global security is at any time unwilling or unable to continue as depository or ceases to be a clearing agency registered under the Exchange Act, and a successor depository registered as a clearing agency under the Exchange Act is not appointed by us within 90 days, we will issue securities in definitive form in exchange for the global security that had been held by the depository. Any securities issued in definitive form in exchange for a global security will be registered in the name or names that the depository gives to the relevant warrant agent, unit agent or other relevant agent of ours or theirs. It is expected that the depository's instructions will be based upon directions received by the depository from participants with respect to ownership of beneficial interests in the global security that had been held by the depository.

PLAN OF DISTRIBUTION

We may sell securities:

- through underwriters;
- through dealers;
- through agents;
- directly to purchasers; or
- through a combination of any of these methods of sale.

In addition, we may issue the securities as a dividend or distribution or in a subscription rights offering to our existing security holders. This prospectus may be used in connection with any offering of our securities through any of these methods or other methods described in the applicable prospectus supplement.

We may directly solicit offers to purchase securities, or agents may be designated to solicit such offers. We will, in the prospectus supplement relating to such offering, name any agent that could be viewed as an underwriter under the Securities Act, and describe any commissions that we must pay. Any such agent will be acting on a best efforts basis for the period of its appointment or, if indicated in the applicable prospectus supplement, on a firm commitment basis.

The distribution of the securities may be effected from time to time in one or more transactions:

- at a fixed price, or prices, which may be changed from time to time;
- at market prices prevailing at the time of sale;
- at prices related to such prevailing market prices; or
- at negotiated prices.

Each prospectus supplement will describe the method of distribution of the securities and any applicable restrictions.

The prospectus supplement with respect to the securities of a particular series will describe the terms of the offering of the securities, including the following:

- the name of the agent or any underwriters;
- the public offering or purchase price and the proceeds we will receive from the sale of the securities;
- any discounts and commissions to be allowed or re-allowed or paid to the agent or underwriters;
- all other items constituting underwriting compensation;
- any discounts and commissions to be allowed or re-allowed or paid to dealers; and
- any exchanges on which the securities will be listed.

If any underwriters or agents are utilized in the sale of the securities in respect of which this prospectus is delivered, we will enter into an underwriting agreement or other agreement with them at the time of sale to them, and we will set forth in the prospectus supplement relating to such offering the names of the underwriters or agents and the terms of the related agreement with them.

If a dealer is utilized in the sale of the securities in respect of which this prospectus is delivered, we will sell such securities to the dealer, as principal. The dealer may then resell such securities to the public at varying prices to be determined by such dealer at the time of resale.

If we offer securities in a subscription rights offering to our existing security holders, we may enter into a standby underwriting agreement with dealers, acting as standby underwriters. We may pay the standby underwriters a commitment fee for the securities they commit to purchase on a standby basis. If we do not enter into a standby underwriting arrangement, we may retain a dealer-manager to manage a subscription rights offering for us.

Remarketing firms, agents, underwriters, dealers and other persons may be entitled under agreements which they may enter into with us to indemnification by us against certain civil liabilities, including liabilities under the Securities Act, and may be customers of, engage in transactions with or perform services for us in the ordinary course of business.

If so indicated in the applicable prospectus supplement, we will authorize underwriters or other persons acting as our agents to solicit offers by certain institutions to purchase securities from us pursuant to delayed delivery contracts providing for payment and delivery on the date stated in the prospectus supplement. Each contract will be for an amount not less than, and the aggregate amount of securities sold pursuant to such contracts shall not be less nor more than, the respective amounts stated in the prospectus supplement. Institutions with whom the contracts, when authorized, may be made include commercial and savings banks, insurance companies, pension funds, investment companies, educational and charitable institutions and other institutions, but shall in all cases be subject to our approval. Delayed delivery contracts will not be subject to any conditions except that:

- the purchase by an institution of the securities covered under that contract shall not at the time of delivery be prohibited under the laws of the jurisdiction to which that institution is subject; and
- if the securities are also being sold to underwriters acting as principals for their own account, the underwriters shall have purchased such securities not sold for delayed delivery. The underwriters and other persons acting as our agents will not have any responsibility in respect of the validity or performance of delayed delivery contracts.

Certain agents, underwriters and dealers, and their associates and affiliates may be customers of, have borrowing relationships with, engage in other transactions with, and/or perform services, including investment banking services, for us or one or more of our respective affiliates in the ordinary course of business.

In order to facilitate the offering of the securities, any underwriters may engage in transactions that stabilize, maintain or otherwise affect the price of the securities or any other securities the prices of which may be used to determine payments on such securities. Specifically, any underwriters may overallocate in connection with the offering, creating a short position for their own accounts. In addition, to cover overallocations or to stabilize the price of the securities or of any such other securities, the underwriters may bid for, and purchase, the securities or any such other securities in the open market. Finally, in any offering of the securities through a syndicate of underwriters, the underwriting syndicate may reclaim selling concessions allowed to an underwriter or a dealer for distributing the securities in the offering if the syndicate repurchases previously distributed securities in transactions to cover syndicate short positions, in stabilization transactions or otherwise. Any of these activities may stabilize or maintain the market price of the securities above independent market levels. Any such underwriters are not required to engage in these activities and may end any of these activities at any time.

Under Rule 15c6-1 of the Exchange Act, trades in the secondary market generally are required to settle in two business days, unless the parties to any such trade expressly agree otherwise or the securities are sold by us to an underwriter in a firm commitment underwritten offering. The applicable prospectus supplement may provide that the original issue date for your securities may be more than two scheduled business days after the trade date for your securities. Accordingly, in such a case, if you wish to trade securities on any date prior to the second business day before the original issue date for

your securities, you will be required, by virtue of the fact that your securities initially are expected to settle in more than two scheduled business days after the trade date for your securities, to make alternative settlement arrangements to prevent a failed settlement.

The securities may be new issues of securities and may have no established trading market. The securities may or may not be listed on a national securities exchange. We can make no assurance as to the liquidity of or the existence of trading markets for any of the securities.

LEGAL MATTERS

Unless the applicable prospectus supplement indicates otherwise, the validity of the securities in respect of which this prospectus is being delivered will be passed upon by Wilmer Cutler Pickering Hale and Dorr LLP. Additional legal matters may be passed upon for us or any underwriters, dealer or agents, by counsel that we will name in the applicable prospectus supplement.

EXPERTS

Ernst & Young, LLP, independent registered public accounting firm, has audited our consolidated financial statements included in our Annual Report on [Form 10-K for the year ended December 31, 2018](#), as set forth in their report, which is incorporated by reference in this prospectus and elsewhere in the registration statement. Our financial statements are incorporated by reference in reliance on Ernst & Young LLP's report, given on their authority as experts in accounting and auditing.

CATABASIS PHARMACEUTICALS, INC.

\$250,000,000
Common Stock
Preferred Stock
Depository Shares
Units
Warrants

PROSPECTUS

, 2019

The information in this prospectus is not complete and may be changed. We may not sell these securities until the registration statement filed with the Securities and Exchange Commission is effective. This prospectus is not an offer to sell these securities and we are not soliciting offers to buy these securities in any jurisdiction where the offer or sale is not permitted.

Subject to completion, dated May 14, 2019

PROSPECTUS

CATABASIS PHARMACEUTICALS, INC.

1,997,000 Shares of Common Stock Underlying Previously Issued Warrants

This prospectus relates to the offer and sale by us of 1,997,000 shares (the "Warrant Shares") of our common stock issuable upon the exercise of outstanding warrants (the "Warrants") that we issued and sold in February 2019 in a public offering of 4,000,000 units (each a "Unit"), each Unit consisting of one share of our common stock and 0.5 of a warrant to purchase one share of our common stock at an exercise price of \$6.25 per share. Each Warrant is exercisable in full and will expire five years from the date of issuance.

Our common stock is listed on the Nasdaq Global Market under the symbol "CATB." On May 10, 2019, the last reported sale price of our common stock on the Nasdaq Global Market was \$7.51 per share.

We are an "emerging growth company" as that term is used in the Jumpstart Our Business Startups Act of 2012 and, as such, have elected to comply with certain reduced public company reporting requirements.

Investing in our securities involves risks. See "Risk Factors" beginning on page SA-5 of this prospectus and the risk factors incorporated by reference into this prospectus.

No underwriter or other person has been engaged by us to facilitate the sale of the Warrant Shares in this offering. We will receive all of the proceeds from any cash exercise of the Warrants. All costs associated with this registration were borne by us. See "Plan of Distribution" beginning on page SA-24 of this prospectus for more information on this offering.

Neither the Securities and Exchange Commission nor any state securities commission has approved or disapproved of these securities or passed upon the adequacy or accuracy of this prospectus. Any representation to the contrary is a criminal offense.

The date of this prospectus is _____, 2019

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ABOUT THIS PROSPECTUS

We have not authorized anyone to provide you with information that is different from that contained in this prospectus or in any free writing prospectus we may authorize to be delivered or made available to you. When you make a decision about whether to invest in our securities, you should not rely upon any information other than the information contained in or incorporated by reference in this prospectus or in any free writing prospectus that we may authorize to be delivered or made available to you. Neither the delivery of this prospectus nor the sale of our securities means that the information contained in this prospectus or any free writing prospectus is correct after the date of this prospectus or such free writing prospectus. This prospectus is not an offer to sell or the solicitation of an offer to buy our securities in any circumstances under which the offer or solicitation is unlawful.

For investors outside the United States: we have not taken any action that would permit this offering or possession or distribution of this prospectus in any jurisdiction where action for that purpose is required, other than in the United States. Persons outside the United States who come into possession of this prospectus must inform themselves about, and observe any restrictions relating to, the offering of the securities covered hereby and the distribution of this prospectus outside the United States.

Unless otherwise indicated, information contained in this prospectus concerning our industry and the markets in which we operate, including our general expectations and market position, market opportunity and market share, is based on information from our own management estimates and research, as well as from industry and general publications and research, surveys and studies conducted by third parties. Management estimates are derived from publicly available information, our knowledge of our industry and assumptions based on such information and knowledge, which we believe to be reasonable. Our management estimates have not been verified by any independent source, and we have not independently verified any third-party information. In addition, assumptions and estimates of our and our industry's future performance are necessarily subject to a high degree of uncertainty and risk due to a variety of factors, including those described in "Risk Factors" beginning on page SA-5 of this prospectus and included in the sections entitled "Risk Factors" in our most [Annual Report on Form 10-K](#) and the other filings we make with the Securities and Exchange Commission from time to time that are incorporated by reference herein. These and other factors could cause our future performance to differ materially from our assumptions and estimates. See "Cautionary Note Regarding Forward-Looking Statements."

We further note that the representations, warranties and covenants made by us in any agreement that is filed as an exhibit to the registration statement of which this prospectus is a part were made solely for the benefit of the parties to such agreement, including, in some cases, for the purpose of allocating risk among the parties to such agreements, and should not be deemed to be a representation, warranty or covenant to you. Moreover, such representations, warranties or covenants were accurate only as of the date when made. Accordingly, such representations, warranties and covenants should not be relied on as accurately representing the current state of our affairs.

We have proprietary rights to trademarks used in this prospectus, including MoveDMD®. Solely for our convenience, trademarks and trade names referred to in this prospectus may appear without the "®" or "™" symbols, but such references are not intended to indicate, in any way, that we will not assert, to the fullest extent possible under applicable law, our rights or the rights to these trademarks and trade names. We do not intend our use or display of other companies' trade names, trademarks or service marks to imply a relationship with, or endorsement or sponsorship of us by, any other companies. Each trademark, trade name, or service mark of any other company appearing in this prospectus is the property of its respective holder.

Unless the context otherwise indicates, references in this prospectus to "we," "our" and "us" refer, collectively, to Catabasis Pharmaceuticals, Inc., a Delaware corporation, and its consolidated subsidiary.

PROSPECTUS SUMMARY

This summary highlights selected information contained elsewhere in this prospectus and in the documents we incorporate by reference. This summary does not contain all of the information you should consider before making an investment decision. You should read this entire prospectus carefully, especially the risks discussed under "Risk Factors" beginning on page 5 of this prospectus, along with our consolidated financial statements and notes to those consolidated financial statements and the other information incorporated by reference in this prospectus.

Overview

We are a clinical-stage biopharmaceutical company focused on the discovery, development and commercialization of novel therapeutics. Our lead product candidate is edasalonexent, formerly known as CAT-1004, an oral small molecule that inhibits NF- κ B, or nuclear factor kappa-light-chain-enhancer of activated B cells, in development for the treatment of Duchenne muscular dystrophy, or DMD. We believe edasalonexent has the potential to be a foundational therapy for all patients affected by DMD regardless of the underlying dystrophin mutation. DMD is an ultimately fatal genetic disorder involving progressive muscle degeneration. The United States Food and Drug Administration has granted orphan drug, fast track and rare pediatric disease designations to edasalonexent for the treatment of DMD. The European Commission has granted orphan medicinal product designation to edasalonexent for the treatment of DMD.

THE OFFERING

Securities offered	1,997,000 Warrant Shares.
Description of Warrants	The Warrants entitle holders to purchase shares of our common stock at an exercise price of \$6.25 per share for a period of five years from February 8, 2019, the date of issuance.
Common stock to be outstanding immediately following this offering	13,493,242 shares assuming exercise of the Warrants in full.
Use of proceeds	We plan to use any proceeds from this offering for clinical trial and other research and development activities; continued growth of our manufacturing capabilities; initial investments in commercial and medical affairs infrastructure to support our transition to a commercial-stage company; and for working capital and other general corporate purposes.
Risk factors	See "Risk Factors" beginning on page SA-5 of this prospectus and the sections entitled "Risk Factors" in our most Annual Report on Form 10-K and the other filings we make with the Securities and Exchange Commission from time to time that are incorporated by reference herein for a discussion of certain factors you should carefully consider before deciding to invest in our securities.
Nasdaq Global Market symbol	Our common stock is listed on the Nasdaq Global Market under the symbol "CATB." There is no established public trading market for the Warrants, and we do not expect a market to develop. We do not intend to apply for listing of the Warrants on any securities exchange or other nationally recognized trading system. Without an active trading market, the liquidity of the Warrants will be limited.

The number of shares of our common stock to be outstanding after this offering is based on 11,496,242 shares of our common stock outstanding as of March 31, 2019.

The number of shares of our common stock to be outstanding after this offering excludes:

- 758,304 shares of our common stock issuable upon the exercise of stock options outstanding as of March 31, 2019 at a weighted-average exercise price of \$18.16 per share;
- 553,014 shares of our common stock available for future issuance as of March 31, 2019 under our 2015 stock incentive plan;
- 112,481 shares of our common stock available for future issuance as of March 31, 2019 under our 2015 employee stock purchase plan;

- 6,201,949 shares of our common stock that had been reserved for issuance in connection with warrants outstanding as of March 31, 2019 (not including the Warrants) at a weighted-average exercise price of \$10.19 per share.

Unless otherwise indicated, all information in this prospectus reflects and assumes:

- a one-for-ten reverse stock split of our common stock that was effected on December 28, 2018;
- no exercise of the outstanding options or warrants described in the bullets above.

RISK FACTORS

Investing in our securities involves a high degree of risk. Before you decide to invest in our securities, you should consider carefully the risks described below and the risks discussed in the sections entitled "Risk Factors" in our most recent [Annual Report on Form 10-K](#) and the other filings we make with the Securities and Exchange Commission from time to time that are incorporated by reference herein, together with the other information contained in this prospectus and the information incorporated by reference herein and in any free writing prospectus that we may authorize for use in connection with this offering. We believe the risks described below and incorporated by reference herein are the risks that are material to us as of the date of this prospectus. If any of these risks actually occur, our business, financial condition, results of operations and future growth prospects could be materially and adversely affected. In these circumstances, the market price of our common stock could decline, and you may lose all or part of your investment.

Risks Related to this Offering

If you purchase shares in this offering by exercising your warrants, you will suffer immediate dilution of your investment.

The exercise price of the warrants to purchase the shares of common stock we are offering in this offering, or the Warrants, is substantially higher than the net tangible book value per share of our common stock. Therefore, if you purchase shares in this offering by exercising your Warrants, you will pay an effective price per share of common stock you acquire that substantially exceeds our net tangible book value per share after this offering. If you exercise a Warrant to purchase a share of our common stock in this offering, and assuming no other Warrants are exercised in this offering, you will experience immediate dilution of approximately \$1.91 per share, representing the difference between our net tangible book value per share as of March 31, 2019 and the exercise price of the Warrants. In addition, if previously issued options to acquire common stock are exercised at prices below the exercise price of the Warrants, you will experience further dilution. For a further description of the dilution that you will experience if you exercise your Warrants, see "Dilution."

There is no public market for the Warrants.

There is no established public trading market for the Warrants, and we do not expect a market to develop. In addition, we do not intend to apply to list the Warrants on any national securities exchange or other nationally recognized trading system, including the Nasdaq Global Market. Without an active market, the liquidity of the Warrants will be limited.

You may experience future dilution as a result of future equity offerings.

In order to raise additional capital, we may in the future offer additional shares of our common stock or other securities convertible into or exchangeable for our common stock at prices that may not be the same as the exercise price of the Warrants. We may sell shares or other securities in any other offering at prices that are less than the exercise price of the Warrants, and investors purchasing shares or other securities in the future could have rights superior to existing stockholders. The prices per share at which we sell additional shares of our common stock, or securities convertible or exchangeable into common stock, in future transactions may be higher or lower than the exercise price of the Warrants.

We have broad discretion over the use of our cash and cash equivalents, including the net proceeds we may receive in this offering, and may not use them effectively.

Our management has broad discretion to use our cash and cash equivalents, including the net proceeds we may receive in this offering, to fund our operations and could spend these funds in ways that do not improve our results of operations or enhance the value of our common stock. The failure

by our management to apply these funds effectively could result in financial losses that could have a material adverse effect on our business, cause the price of our common stock to decline and delay the development of our product candidates. Pending their use to fund operations, we may invest our cash and cash equivalents in a manner that does not produce income or that loses value.

Holders of the Warrants will have no rights as common stockholders until such holders exercise their Warrants and acquire our common stock.

Until holders of Warrants acquire shares of our common stock upon exercise thereof, such holders will have no rights with respect to the shares of our common stock underlying the Warrants. Upon exercise of the Warrants, the holders will be entitled to exercise the rights of a common stockholder only as to matters for which the record date occurs after the exercise date.

The Warrants are speculative in nature.

The Warrants do not confer any rights of common stock ownership on their holders, such as voting rights or the right to receive dividends, but rather merely represent the right to acquire shares of common stock at a fixed price for a limited period of time. Specifically, commencing on the date of issuance, holders of the Warrants may exercise their right to acquire the common stock and pay an exercise price of \$6.25 per share, subject to certain adjustments, prior to five years from the date of issuance, after which date any unexercised Warrants will expire and have no further value. Moreover, the market value of the Warrants, if any, is uncertain. The Warrants will not be listed or quoted for trading on any market or exchange. There can be no assurance that the market price of the common stock will ever equal or exceed the exercise price of the Warrants, and consequently, it may not ever be profitable for holders of the Warrants to exercise the Warrants.

FORWARD-LOOKING STATEMENTS

This prospectus and the information incorporated by reference in this prospectus include "forward-looking statements" within the meaning of Section 27A of the Securities Act of 1933, as amended, or the Securities Act, and Section 21E of the Exchange Act. All statements, other than statements of historical facts, contained or incorporated by reference in this prospectus, including statements regarding our strategy, future operations, future financial position, future revenue, projected costs, prospects, plans and objectives of management and expected market growth are forward-looking statements. The words "anticipate," "believe," "continue," "could," "estimate," "expect," "intend," "may," "plan," "potential," "predict," "project," "should," "target," "would" and similar expressions are intended to identify forward-looking statements, although not all forward-looking statements contain these identifying words.

These forward-looking statements include, among other things, statements about:

- our expectations regarding our ability to successfully conduct the PolarisDMD trial, and our expectations regarding the timing and results of such trial, including reporting top-line results of this trial in the second half of 2020 and the potential consistency of data produced by this trial with prior results from our MoveDMD® trial, as well as any new data and analyses relating to the safety profile and potential clinical benefits of edasalonexent;
- our expectations regarding our ability to successfully conduct the GalaxyDMD open-label extension trial, including the anticipated announcement of data from this trial;
- our plans to identify, develop and commercialize novel therapeutics based on our SMART Linker™ drug discovery platform;
- ongoing and planned clinical trials for edasalonexent and other product candidates, whether conducted by us or by any future collaborators, including the timing of initiation of these trials and the anticipated announcement of results;
- our plans to enter into collaborations for the development and commercialization of product candidates;
- the potential benefits of any future collaboration;
- our ability to receive research and development funding and achieve anticipated milestones under any future collaborations;
- the timing of and our ability to obtain and maintain regulatory approvals for our product candidates;
- the rate and degree of market acceptance and clinical utility of any products for which we receive marketing approval;
- our commercialization, marketing and manufacturing capabilities and strategy;
- our intellectual property position and strategy;
- our ability to identify additional products or product candidates with significant commercial potential;
- our estimates regarding expenses, future revenue, capital requirements and needs for additional financing;
- developments relating to our competitors and our industry; and
- the impact of government laws and regulations.

You are cautioned that these forward-looking statements are only predictions and are subject to risks, uncertainties and assumptions, including those referenced in the section of this prospectus entitled "Risk Factors" and in the sections entitled "Risk Factors" in our most recent [Annual Report on Form 10-K](#) and the other filings we make with the Securities and Exchange Commission, or the SEC, from time to time that are incorporated by reference herein. We undertake no obligation to revise or update any forward-looking statements, except to the extent required by law.

USE OF PROCEEDS

If the warrants to purchase the shares of our common stock we are offering in this offering are exercised in full, we will receive gross proceeds of \$12.5 million, however we do not know when, if or the extent to which such warrants may be exercised, and it is possible that no warrants may be exercised, in which case we would not receive any proceeds from this offering.

We plan to use any proceeds from this offering for clinical trial and other research and development activities; continued growth of our manufacturing capabilities; initial investments in commercial and medical affairs infrastructure to support our transition to a commercial-stage company; and for working capital and other general corporate purposes.

Pending our use of any proceeds from this offering, we intend to invest any such proceeds in short term, investment grade, interest-bearing instruments and U.S. government securities.

DIVIDEND POLICY

We have never declared nor paid cash dividends on our common stock. We currently intend to retain all of our future earnings, if any, to finance the growth and development of our business. We do not intend to pay cash dividends in respect of our common stock in the foreseeable future.

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DILUTION

Our net tangible book value as of March 31, 2019 was approximately \$49.9 million, or approximately \$4.34 per share of common stock. Net tangible book value per share is equal to our total tangible assets, less our total liabilities, divided by the number of shares outstanding as of the date in question. Dilution with respect to net tangible book value per share represents the difference between the exercise price of the warrants to purchase the shares of common stock we are offering in this offering, or the Warrants, and the net tangible book value per share of our common stock immediately after the exercise of the Warrant being exercised.

If you exercise a Warrant to purchase a share of our common stock in this offering, and assuming no other Warrants are exercised in this offering, you will experience immediate dilution of approximately \$1.91 per share, representing the difference between our net tangible book value per share as of March 31, 2019 and the exercise price of the Warrants.

In addition, if previously issued options to acquire common stock are exercised at prices below the exercise price of the Warrants, you will experience further dilution.

The discussion above is based on 11,496,242 shares of our common stock outstanding as of March 31, 2019. The number of shares outstanding as of March 31, 2019 excludes:

- 758,304 shares of our common stock issuable upon the exercise of stock options outstanding as of March 31, 2019 at a weighted-average exercise price of \$18.16 per share;
- 553,014 shares of our common stock available for future issuance as of March 31, 2019 under our 2015 stock incentive plan;
- 112,481 shares of our common stock available for future issuance as of March 31, 2019 under our 2015 employee stock purchase plan;
- 6,201,949 shares of our common stock that had been reserved for issuance in connection with warrants outstanding as of March 31, 2019, including the Warrants, at a weighted-average exercise price of \$10.19 per share.

DESCRIPTION OF CAPITAL STOCK

The following description of our capital stock is intended as a summary only and therefore is not a complete description of our capital stock. This description is based upon, and is qualified by reference to, our certificate of incorporation, our by-laws and applicable provisions of Delaware corporate law. You should read our certificate of incorporation and by-laws, which are filed as exhibits to the registration statement of which this prospectus forms a part, for the provisions that are important to you.

Our authorized capital stock consists of 150,000,000 shares of common stock, \$0.001 par value per share, and 5,000,000 shares of preferred stock, \$0.001 par value per share. As of March 31, 2019, 11,496,242 shares of common stock were outstanding and no shares of preferred stock were outstanding.

Common Stock

Voting Rights. Holders of our common stock are entitled to one vote for each share held on all matters submitted to a vote of stockholders, except that unless otherwise required by law, holders of our common stock are not entitled to vote on any amendment to the certificate of incorporation that relates solely to the terms of one or more outstanding series of preferred stock, if the holders of such affected series are entitled, either separately or together as a class with the holders of one or more such other series, to vote thereon pursuant to the certificate of incorporation. Holders of our common stock do not have cumulative voting rights.

An election of directors will be decided by a plurality of the votes cast by the stockholders entitled to vote on the election at a duly held stockholders' meeting at which a quorum is present. All other questions will be decided by a majority of the votes cast by stockholders entitled to vote thereon at a duly held meeting of stockholders at which a quorum is present, except when a different vote is required by law, our certificate of incorporation or by-laws.

Dividends. Holders of common stock are entitled to receive proportionately any dividends as may be declared by our board of directors, subject to any preferential dividend or other rights of any series of preferred stock that we may designate and issue in the future.

Liquidation and Dissolution. In the event of our liquidation or dissolution, the holders of common stock are entitled to receive proportionately our net assets available for distribution to stockholders after the payment of all debts and other liabilities and subject to the prior rights of any outstanding preferred stock.

Other Rights. Holders of common stock have no preemptive, subscription, redemption or conversion rights. The rights, preferences and privileges of holders of common stock are subject to and may be adversely affected by the rights of the holders of shares of any series of preferred stock that we may designate and issue in the future.

Transfer Agent and Registrar. The transfer agent and registrar for our common stock is American Stock Transfer & Trust Company, LLC.

Listing on The Nasdaq Global Market. Our common stock is listed on The Nasdaq Global Market under the symbol "CATB."

Preferred Stock

We currently have no outstanding shares of preferred stock. Under our restated certificate of incorporation, we are authorized to issue "blank check" preferred stock, which may be issued in one or more series upon authorization of our board of directors. Our board of directors is authorized to fix

the designation of the series, the number of authorized shares of the series, dividend rights and terms, conversion rights, voting rights, redemption rights and terms, liquidation preferences and any other rights, powers, preferences and limitations applicable to each series of preferred stock. The authorized shares of our preferred stock are available for issuance without further action by our stockholders, unless such action is required by applicable law or the rules of any stock exchange on which our securities may be listed. If the approval of our stockholders is not required for the issuance of shares of our preferred stock, our board may determine not to seek stockholder approval.

A series of our preferred stock could, depending on the terms of such series, impede the completion of a merger, tender offer or other takeover attempt. Our board of directors will make any determination to issue preferred shares based upon its judgment as to the best interests of our stockholders. Our directors, in so acting, could issue preferred stock having terms that could discourage an acquisition attempt through which an acquirer may be able to change the composition of our board of directors, including a tender offer or other transaction that some, or a majority, of our stockholders might believe to be in their best interests or in which stockholders might receive a premium for their stock over the then-current market price of the stock.

Stock Options

As of March 31, 2019, options to purchase 758,304 shares of our common stock at a weighted-average exercise price of \$18.16 per share were outstanding, of which options to purchase 197,643 shares of our common stock were exercisable, at a weighted-average exercise price of \$46.85 per share.

Warrants

As of March 31, 2019, we had outstanding warrants, including the Warrants, to purchase shares of our common stock exercisable for an aggregate of 6,201,949 shares of our common stock at a weighted-average exercise price of \$10.19 per share.

Registration Rights

Our second amended and restated investor rights agreement, or the Investor Rights Agreement, provides certain holders of our preferred stock, including some of our directors and 5% stockholders and their respective affiliates and entities affiliated with our officers and directors, the right to require us to file registration statements under the Securities Act covering their shares or to include their shares in registration statements that we may file for ourselves or other stockholders. In addition, the holders of warrants to purchase shares of our preferred stock have rights under those warrants to become party to the Investor Rights Agreement following exercise of the warrants, following which they will have, with respect to the shares acquired on exercise of the warrants, the same rights to require us to register the shares as the other investor parties to the Investor Rights Agreement. After registration pursuant to these rights, these shares will become freely tradable without restriction under the Securities Act in the public market, subject to volume limitations applicable to affiliates.

Demand Registration Rights. Subject to specified limitations set forth in the Investor Rights Agreement, at any time the holders of a majority of then outstanding registrable securities, as defined in the Investor Rights Agreement, acting together, may demand in writing that we register their registrable securities under the Securities Act so long as the total amount of registrable shares requested to be registered has an anticipated aggregate offering price to the public, net of selling expenses, of least \$10.0 million. We are not obligated to file a registration statement pursuant to this demand provision on more than two occasions, subject to specified exceptions.

In addition, at any time when we are eligible to file a registration statement on Form S-3 under the Securities Act, subject to specified limitations, the holders of at least 35% of the registrable securities then outstanding may demand in writing that we register on Form S-3 registrable shares held

by them so long as the total amount of registrable shares requested to be registered has an anticipated aggregate offering price to the public, net of selling expenses, of least \$1.0 million.

Incidental Registration Rights. If we propose to file a registration statement to register any of our securities under the Securities Act, either for our own account or for the account of any of our stockholders that are not holders of registrable shares, solely for cash and on a form that would also permit the registration of registrable shares, the holders of our registrable shares are entitled to notice of registration and, subject to specified exceptions, we will be required to register the registrable shares then held by them that they request that we register.

Expenses. Pursuant to the Investor Rights Agreement, we are required to pay all registration expenses, including registration fees, printing expenses, fees and disbursements of our counsel and accountants and reasonable fees and disbursements of one counsel representing the selling stockholders, other than any underwriting discounts and commissions, related to any demand or incidental registration. The Investor Rights Agreement contains customary cross-indemnification provisions, pursuant to which we are obligated to indemnify the selling stockholders in the event of material misstatements or omissions in the registration statement attributable to us, and they are obligated to indemnify us for material misstatements or omissions in the registration statement attributable to them.

Provisions of Our Certificate of Incorporation and By-laws and Delaware Law That May Have Anti-Takeover Effects

Delaware law, our certificate of incorporation and our by-laws contain provisions that could have the effect of delaying, deferring or discouraging another party from acquiring control of us. These provisions, which are summarized below, are expected to discourage coercive takeover practices and inadequate takeover bids. These provisions are also designed to encourage persons seeking to acquire control of us to first negotiate with our board of directors.

Staggered Board; Removal of Directors. Our certificate of incorporation and by-laws divide our board of directors into three classes with staggered three-year terms. In addition, a director is only able to be removed for cause and only by the affirmative vote of the holders of at least 75% of the votes that all of our stockholders would be entitled to cast in an annual election of directors. Any vacancy on our board of directors, including a vacancy resulting from an enlargement of our board of directors, is only able to be filled by vote of a majority of our directors then in office. The classification of our board of directors and the limitations on the removal of directors and filling of vacancies could make it more difficult for a third party to acquire, or discourage a third party from seeking to acquire, control of our company.

Stockholder Action by Written Consent; Special Meetings. Our certificate of incorporation provides that any action required or permitted to be taken by our stockholders must be effected at a duly called annual or special meeting of our stockholders and may not be effected by any consent in writing by our stockholders. Our certificate of incorporation and by-laws also provide that, except as otherwise required by law, special meetings of our stockholders can only be called by our chairman of the board, our chief executive officer or our board of directors.

Advance Notice Requirements for Stockholder Proposals. Our by-laws establish an advance notice procedure for stockholder proposals to be brought before an annual meeting of stockholders, including proposed nominations of persons for election to our board of directors. Stockholders at an annual meeting are only able to consider proposals or nominations specified in the notice of meeting or brought before the meeting by or at the direction of our board of directors or by a stockholder of record on the record date for the meeting who is entitled to vote at the meeting and who has delivered timely written notice in proper form to our secretary of the stockholder's intention to bring such

business before the meeting. These provisions could have the effect of delaying until the next stockholder meeting stockholder actions that are favored by the holders of a majority of our outstanding voting securities.

Delaware Business Combination Statute. We are subject to Section 203 of the General Corporation Law of the State of Delaware. Subject to certain exceptions, Section 203 prevents a publicly held Delaware corporation from engaging in a "business combination" with any "interested stockholder" for three years following the date that the person became an interested stockholder, unless the interested stockholder attained such status with the approval of our board of directors or unless the business combination is approved in a prescribed manner. A "business combination" includes, among other things, a merger or consolidation involving us and the "interested stockholder" and the sale of more than 10% of our assets. In general, an "interested stockholder" is any entity or person beneficially owning 15% or more of our outstanding voting stock and any entity or person affiliated with or controlling or controlled by such entity or person.

Amendment of Certificate of Incorporation and By-laws. The General Corporation Law of the State of Delaware provides generally that the affirmative vote of a majority of the shares entitled to vote on any matter is required to amend a corporation's certificate of incorporation or by-laws, unless a corporation's certificate of incorporation or by-laws, as the case may be, requires a greater percentage. Our by-laws may be amended or repealed by a majority vote of our board of directors or by the affirmative vote of the holders of at least 75% of the votes that all of our stockholders would be entitled to cast in any annual election of directors. In addition, the affirmative vote of the holders of at least 75% of the votes that all of our stockholders would be entitled to cast in any annual election of directors is required to amend or repeal or to adopt any provisions inconsistent with any of the provisions of our certificate of incorporation described above under "*Staggered Board; Removal of Directors*" and "*Stockholder Action by Written Consent; Special Meetings*."

Exclusive Forum Selection. Our certificate of incorporation provides that, unless we consent in writing to the selection of an alternative forum, the Court of Chancery of the State of Delaware (or if the Court of Chancery does not have jurisdiction, the federal district court for the District of Delaware) shall be the sole and exclusive forum for (1) any derivative action or proceeding brought on behalf of our company, (2) any action asserting a claim of breach of a fiduciary duty owed by any of our directors, officers or employees to our company or our stockholders, (3) any action asserting a claim against our company arising pursuant to any provision of the General Corporation Law of the State of Delaware or our certificate of incorporation or by-laws, or (4) any action asserting a claim against our company governed by the internal affairs doctrine. Although our certificate of incorporation contains the choice of forum provision described above, it is possible that a court could rule that such a provision is inapplicable for a particular claim or action or that such provision is unenforceable.

Authorized but Unissued Shares. Our authorized but unissued shares of common stock and preferred stock are available for future issuance without stockholder approval, subject to any limitations imposed by the listing requirements of the Nasdaq Global Market. These additional shares may be used for a variety of corporate finance transactions, acquisitions and employee benefit plans. The existence of authorized but unissued and unreserved common stock and preferred stock could make it more difficult or discourage an attempt to obtain control of us by means of a proxy contest, tender offer, merger or otherwise.

DESCRIPTION OF WARRANTS

We are offering 1,997,000 shares, or the Warrant Shares, of our common stock issuable upon the exercise of outstanding warrants, or the Warrants, that we issued and sold in February 2019 in a public offering of 4,000,000 units, or the Units, each Unit consisting of one share of our common stock and 0.5 of a warrant to purchase one share of our common stock at an exercise price of \$6.25 per share. The following summary of certain terms and provisions of the Warrants is not complete and is subject to, and qualified in its entirety by, the provisions of the Warrants. Prospective investors should carefully review the terms and provisions of the form of Warrant for a complete description of the terms and conditions of the Warrants.

Duration and Exercise Price

Each Warrant has an exercise price of \$6.25 per share, is exercisable in full and will expire on the fifth anniversary the original issuance date. The exercise price and number of shares of common stock issuable upon exercise is subject to appropriate adjustment in the event of stock dividends, stock splits, reorganizations or similar events affecting our common stock and the exercise price. The Warrants were issued separately from the common stock included in the Units.

Cashless Exercise

If, at the time a holder exercises its Warrants, a registration statement registering the issuance of the shares of common stock underlying the Warrants under the Securities Act is not then effective or available for the issuance of such shares, then in lieu of making the cash payment otherwise contemplated to be made to us upon such exercise in payment of the aggregate exercise price, the holder may elect instead to receive upon such exercise (either in whole or in part) the net number of shares of common stock determined according to a formula set forth in the Warrants.

Exercisability

The Warrants are exercisable, at the option of each holder, in whole or in part, by delivering to us a duly executed exercise notice accompanied by payment in full for the number of shares of our common stock purchased upon such exercise (except in the case of a cashless exercise as discussed above). A holder (together with its affiliates) may not exercise any portion of a Warrant to the extent that the holder would own more than 4.99% of the outstanding common stock immediately after exercise, except that upon at least 61 days' prior notice from the holder to us, the holder may increase the amount of ownership of outstanding stock after exercising the holder's Warrants up to 9.99% of the number of shares of our common stock outstanding immediately after giving effect to the exercise, as such percentage ownership is determined in accordance with the terms of the Warrants. Purchasers of Warrants were also able elect prior to the issuance of Warrants to have the initial exercise limitation set at 9.99% of our outstanding common stock.

Fractional Shares

No fractional shares of common stock will be issued upon the exercise of the Warrants. Rather, the number of shares of common stock to be issued will be rounded to the nearest whole number.

Transferability

Subject to applicable laws, a Warrant may be transferred at the option of the holder upon surrender of the Warrant to us together with the appropriate instruments of transfer.

Exchange Listing

We do not intend to list the Warrants on any securities exchange or nationally recognized trading system. The common stock issuable upon exercise of the Warrants is currently listed on the Nasdaq Global Market.

Right as a Stockholder

Except as otherwise provided in the Warrants or by virtue of such holder's ownership of shares of our common stock, the holders of the Warrants do not have the rights or privileges of holders of our common stock, including any voting rights, until they exercise their Warrants.

Fundamental Transaction

In the event of a fundamental transaction, as described in the Warrants and generally including any reorganization, recapitalization or reclassification of our common stock, the sale, transfer or other disposition of all or substantially all of our properties or assets, our consolidation or merger with or into another person, the acquisition of at least 50% of our outstanding common stock, or any person or group becoming the beneficial owner of at least 50% of the voting power represented by our outstanding common stock, the holders of the Warrants will be entitled to receive upon exercise of the Warrants the kind and amount of securities, cash or other property that the holders would have received had they exercised the Warrants immediately prior to such fundamental transaction. In addition, in the event of a fundamental transaction which is approved by our Board, the holders of the Warrants have the right to require us or a successor entity to redeem the Warrants for cash in the amount of the Black-Scholes value of the unexercised portion of the Warrants on the date of the consummation of the fundamental transaction. In the event of a fundamental transaction which is not approved by our Board, the holders of the Warrants have the right to require us or a successor entity to redeem the Warrants for the consideration paid in the fundamental transaction in the amount of the Black Scholes value of the unexercised portion of the Warrants on the date of the consummation of the fundamental transaction payable at our option in either shares of our common stock (or, in certain cases, in the securities of the successor entity) or cash.

MATERIAL U.S. FEDERAL TAX CONSIDERATIONS FOR HOLDERS OF OUR COMMON STOCK AND WARRANTS

The following discussion describes the material U.S. federal income tax consequences of the acquisition, ownership and disposition of our common stock and the warrants to purchase the shares of our common stock we are offering in this offering, or the Warrants. This discussion is based on the current provisions of the Internal Revenue Code of 1986, as amended, referred to as the Code, existing and proposed U.S. Treasury regulations promulgated thereunder, and administrative rulings and court decisions in effect as of the date hereof, all of which are subject to change at any time, possibly with retroactive effect. No ruling has been or will be sought from the Internal Revenue Service, or IRS, with respect to the matters discussed below, and there can be no assurance the IRS will not take a contrary position regarding the tax consequences of the acquisition, ownership or disposition of our common stock or Warrants, or that any such contrary position would not be sustained by a court.

We assume in this discussion that the shares of our common stock and Warrants will be held as capital assets (generally, property held for investment). This discussion does not address all aspects of U.S. federal income taxes, does not discuss the potential application of the Medicare contribution tax, or the alternative minimum tax and does not address state or local taxes or U.S. federal gift and estate tax laws, except as specifically provided below with respect to non-U.S. holders, or any non-U.S. tax consequences that may be relevant to holders in light of their particular circumstances. This discussion also does not address the special tax rules applicable to particular holders, such as:

- financial institutions;
- brokers or dealers in securities;
- tax-exempt organizations;
- pension plans;
- regulated investment companies;
- owners that hold our common stock or Warrants as part of a straddle, hedge, conversion transaction, synthetic security or other integrated investment;
- insurance companies;
- controlled foreign corporations, passive foreign investment companies, or corporations that accumulate earnings to avoid U.S. federal income tax; and
- certain U.S. expatriates.

In addition, this discussion does not address the tax treatment of partnerships or other pass-through entities or persons who hold our common stock or Warrants through partnerships or other entities which are pass-through entities for U.S. federal income tax purposes. A partner in a partnership or other pass-through entity that will hold our common stock or Warrants should consult his, her or its own tax advisor regarding the tax consequences of the ownership and disposition of our common stock or Warrants through a partnership or other pass-through entity, as applicable.

This discussion of U.S. federal income tax considerations is for general information purposes only and is not tax advice. Prospective investors should consult their own tax advisors regarding the U.S. federal, state, local and non-U.S. income and other tax considerations of acquiring, holding and disposing of our common stock and Warrants.

For the purposes of this discussion, a "U.S. Holder" means a beneficial owner of our common stock or Warrants that is for U.S. federal income tax purposes (a) an individual citizen or resident of the United States, (b) a corporation (or other entity taxable as a corporation for U.S. federal income tax purposes), created or organized in or under the laws of the United States, any state thereof or the

District of Columbia, (c) an estate the income of which is subject to U.S. federal income taxation regardless of its source, or (d) a trust if it (1) is subject to the primary supervision of a court within the United States and one or more U.S. persons (within the meaning of Section 7701(a)(30) of the Code) have the authority to control all substantial decisions of the trust or (2) has a valid election in effect under applicable U.S. Treasury regulations to be treated as a U.S. person. A "Non-U.S. Holder" is, for U.S. federal income tax purposes, a beneficial owner of common stock or Warrants that is not a U.S. Holder or a partnership for U.S. federal income tax purposes.

Tax Cuts and Jobs Act

Under tax legislation signed into law in December 2017 commonly known as the Tax Cuts and Jobs Act of 2017, U.S. Holders that use an accrual method of accounting for tax purposes and have certain financial statements generally will be required to include certain amounts in income no later than the time such amounts are taken into account as revenue in such financial statements. The application of this rule thus may require the accrual of income earlier than would be the case under the general tax rules described below, although the precise application of this rule is unclear at this time. U.S. Holders that use an accrual method of accounting should consult with their tax advisors regarding the potential applicability of this legislation to their particular situation.

Tax Considerations Applicable to U.S. Holders

Exercise and Expiration of Warrants

In general, a U.S. Holder will not recognize gain or loss for U.S. federal income tax purposes upon exercise of a Warrant. The U.S. Holder will take a tax basis in the shares acquired on the exercise of a Warrant equal to the exercise price of the Warrant, increased by the U.S. Holder's adjusted tax basis in the Warrant exercised. The U.S. Holder's holding period in the shares of our common stock acquired on exercise of the Warrant will begin on the date of exercise of the Warrant, and will not include any period for which the U.S. Holder held the Warrant.

In certain limited circumstances, a U.S. Holder may be permitted to undertake a cashless exercise of Warrants into our common stock. The U.S. federal income tax treatment of a cashless exercise of Warrants into our common stock is unclear, and the tax consequences of a cashless exercise could differ from the consequences upon the exercise of a Warrant described in the preceding paragraph. U.S. Holders should consult their own tax advisors regarding the U.S. federal income tax consequences of a cashless exercise of Warrants.

The lapse or expiration of a Warrant will be treated as if the U.S. Holder sold or exchanged the Warrant and recognized a capital loss equal to the U.S. Holder's tax basis in the Warrant. The deductibility of capital losses is subject to limitations.

Certain Adjustments to and Distributions on Warrants

Under Section 305 of the Code, an adjustment to the number of shares of common stock issued on the exercise of the Warrants, or an adjustment to the exercise price of the Warrants, may be treated as a constructive distribution to a U.S. Holder of the Warrants if, and to the extent that, such adjustment has the effect of increasing such U.S. Holder's proportionate interest in our "earnings and profits" or assets, depending on the circumstances of such adjustment (for example, if such adjustment is to compensate for a distribution of cash or other property to our shareholders). An adjustment made pursuant to a bona fide reasonable adjustment formula that has the effect of preventing dilution should generally not be considered to result in a constructive distribution. Any such constructive distribution would be taxable whether or not there is an actual distribution of cash or other property to the holders of Warrants. In certain circumstances, if we were to make a distribution in cash or other property with respect to our common stock after the issuance of the Warrants, then we may make a corresponding

distribution to a Warrant holder. The taxation of a distribution received with respect to a Warrant is unclear. It is possible such a distribution would be treated as a distribution (or constructive distribution), although other treatments are possible. For more information regarding the tax considerations related to distributions, see the discussion below regarding "Distributions." U.S. Holders should consult their tax advisors regarding the proper treatment of any adjustments to the Warrants and any distributions with respect to the Warrants.

Distributions

As discussed above, we currently anticipate that we will retain future earnings, if any, to finance the growth and development of our business and do not intend to pay cash dividends in respect of our common stock in the foreseeable future. In the event that we do make distributions on our common stock to a U.S. Holder, those distributions generally will constitute dividends for U.S. tax purposes to the extent paid out of our current or accumulated earnings and profits (as determined under U.S. federal income tax principles). Distributions in excess of our current and accumulated earnings and profits will constitute a return of capital that is applied against and reduces, but not below zero, a U.S. Holder's adjusted tax basis in our common stock. Any remaining excess will be treated as gain realized on the sale or exchange of our common stock as described below under the section titled "Disposition of Our Common Stock or Warrants."

Disposition of Our Common Stock or Warrants

Upon a sale or other taxable disposition of our common stock or Warrants, a U.S. Holder generally will recognize capital gain or loss in an amount equal to the difference between the amount realized and the U.S. Holder's adjusted tax basis in the common stock or Warrants. Capital gain or loss will constitute long-term capital gain or loss if the U.S. Holder's holding period for the common stock or Warrants exceeds one year. The deductibility of capital losses is subject to certain limitations. U.S. Holders who recognize losses with respect to a disposition of our common stock or Warrants should consult their own tax advisors regarding the tax treatment of such losses.

Information Reporting and Backup Reporting

Information reporting requirements generally will apply to payments of dividends (including constructive dividends) on the common stock and Warrants and to the proceeds of a sale or other disposition of common stock and Warrants paid by us to a U.S. Holder unless such U.S. Holder is an exempt recipient, such as a corporation. Backup withholding will apply to those payments if the U.S. Holder fails to provide the holder's taxpayer identification number, or certification of exempt status, or if the holder otherwise fails to comply with applicable requirements to establish an exemption.

Backup withholding is not an additional tax. Rather, any amounts withheld under the backup withholding rules will be allowed as a refund or a credit against the U.S. Holder's U.S. federal income tax liability provided the required information is timely furnished to the IRS. U.S. Holders should consult their own tax advisors regarding their qualification for exemption from information reporting and backup withholding and the procedure for obtaining such exemption.

Tax Considerations Applicable to Non-U.S. Holders

Exercise and Expiration of Warrants

In general, a Non-U.S. Holder will not recognize gain or loss for U.S. federal income tax purposes upon the exercise of Warrants into shares of common stock. The U.S. federal income tax treatment of a cashless exercise of Warrants into our common stock is unclear. A Non-U.S. Holder should consult his, her, or its own tax advisor regarding the U.S. federal income tax consequences of a cashless exercise of Warrants.

The expiration of a Warrant will be treated as if the Non-U.S. Holder sold or exchanged the Warrant and recognized a capital loss equal to the Non-U.S. Holder's tax basis in the Warrant. However, a Non-U.S. Holder will not be able to utilize a loss recognized upon expiration of a Warrant against the Non-U.S. Holder's U.S. federal income tax liability unless the loss is effectively connected with the Non-U.S. Holder's conduct of a trade or business within the United States (and, if an income tax treaty applies, is attributable to a permanent establishment or fixed base in the United States) or is treated as a U.S.-source loss and the Non-U.S. Holder is present 183 days or more in the taxable year of disposition and certain other conditions are met.

Certain Adjustments to and Distributions on Warrants

As described under "—U.S. Holders—Certain Adjustments to Warrants," an adjustment to the Warrants could result in a constructive distribution to a Non-U.S. Holder, which would be treated as described under "—Distributions" below, and the tax treatment of distributions on the Warrants is unclear. Any resulting withholding tax attributable to deemed dividends would be collected from other amounts payable or distributable to the Non-U.S. Holder. Non-U.S. Holders should consult their tax advisors regarding the proper treatment of any adjustments to and distributions on the Warrants.

Distributions

As discussed above, we currently anticipate that we will retain future earnings, if any, to finance the growth and development of our business and do not intend to pay cash dividends in respect of our common stock in the foreseeable future. In the event that we do make distributions on our common stock to a Non-U.S. Holder, those distributions generally will constitute dividends for U.S. federal income tax purposes as described in "—U.S. Holders—Distributions."

Any distribution (including constructive distributions) on our common stock that is treated as a dividend paid to a Non-U.S. Holder that is not effectively connected with the holder's conduct of a trade or business in the United States will generally be subject to withholding tax at a 30% rate or such lower rate as may be specified by an applicable income tax treaty between the United States and the Non-U.S. Holder's country of residence. To obtain a reduced rate of withholding under a treaty, a Non-U.S. Holder generally will be required to provide the applicable withholding agent with a properly executed IRS Form W-8BEN, IRS Form W-8BEN-E or other appropriate form, certifying the Non-U.S. Holder's entitlement to benefits under that treaty. Such form must be provided prior to the payment of dividends and must be updated periodically. If a Non-U.S. Holder holds stock through a financial institution or other agent acting on the holder's behalf, the holder will be required to provide appropriate documentation to such agent. The holder's agent may then be required to provide certification to the applicable withholding agent, either directly or through other intermediaries. If you are eligible for a reduced rate of U.S. withholding tax under an income tax treaty, you should consult with your own tax advisor to determine if you are able to obtain a refund or credit of any excess amounts withheld by timely filing an appropriate claim for a refund with the IRS.

We generally are not required to withhold tax on dividends paid (or constructive dividends deemed paid) to a Non-U.S. Holder that are effectively connected with the holder's conduct of a trade or business within the United States (and, if required by an applicable income tax treaty, are attributable to a permanent establishment or fixed base that the holder maintains in the United States) if a properly executed IRS Form W-8ECI, stating that the dividends are so connected, is furnished to us (or, if stock is held through a financial institution or other agent, to the applicable withholding agent). In general, such effectively connected dividends will be subject to U.S. federal income tax on a net income basis at the regular graduated rates applicable to U.S. persons. A corporate Non-U.S. Holder receiving effectively connected dividends may also be subject to an additional "branch profits tax," which is imposed, under certain circumstances, at a rate of 30% (or such lower rate as may be specified

by an applicable treaty) on the corporate Non-U.S. Holder's effectively connected earnings and profits, subject to certain adjustments.

See also the sections below titled "—Backup Withholding and Information Reporting" and "—Foreign Accounts" for additional withholding rules that may apply to dividends paid to certain foreign financial institutions or non-financial foreign entities.

Disposition of Our Common Stock or Warrants

Subject to the discussions below under the sections titled "—Backup Withholding and Information Reporting" and "—Foreign Accounts," a Non-U.S. Holder generally will not be subject to U.S. federal income or withholding tax with respect to gain realized on a sale or other disposition of our common stock or Warrants unless:

- the gain is effectively connected with the Non-U.S. Holder's conduct of a trade or business in the United States, and if an applicable income tax treaty so provides, the gain is attributable to a permanent establishment or fixed base maintained by the Non-U.S. Holder in the United States; in these cases, the Non-U.S. Holder will be taxed on a net income basis at the regular graduated rates and in the manner applicable to U.S. persons, and if the Non-U.S. Holder is a corporation, an additional branch profits tax at a rate of 30%, or a lower rate as may be specified by an applicable income tax treaty, may also apply;
- the Non-U.S. Holder is a nonresident alien present in the United States for 183 days or more in the taxable year of the disposition and certain other requirements are met, in which case the Non-U.S. Holder will be subject to a 30% tax (or such lower rate as may be specified by an applicable income tax treaty between the United States and such holder's country of residence) on the net gain derived from the disposition, which may be offset by certain U.S.-source capital losses of the Non-U.S. Holder, if any; or
- our common stock constitutes a U.S. real property interest because we are, or have been at any time during the five-year period preceding such disposition (or the Non-U.S. Holder's holding period of the common stock or Warrants, if shorter), a "U.S. real property holding corporation," unless our common stock is regularly traded on an established securities market and the Non-U.S. Holder held no more than 5% of our outstanding common stock, directly or indirectly, during the shorter of the five-year period ending on the date of the disposition or the period that the Non-U.S. Holder held our common stock. Special rules may apply to the determination of the 5% threshold in the case of a holder of Warrant. Non-U.S. Holders are urged to consult their own tax advisors regarding the effect of holding our Warrants on the calculation of such 5% threshold. Generally, a corporation is a "U.S. real property holding corporation" if the fair market value of its "U.S. real property interests" (as defined in the Code and applicable regulations) equals or exceeds 50% of the sum of the fair market value of its worldwide real property interests plus its other assets used or held for use in a trade or business. Although there can be no assurance, we believe that we are not currently, and we do not anticipate becoming, a "U.S. real property holding corporation" for U.S. federal income tax purposes. No assurance can be provided that our common stock will be regularly traded on an established securities market for purposes of the rules described above. Non-U.S. Holders are urged to consult their own tax advisors regarding the U.S. federal income tax considerations that could result if we are, or become, a "U.S. real property holding corporation."

See the sections titled "—Backup Withholding and Information Reporting" and "—Foreign Accounts" for additional information regarding withholding rules that may apply to proceeds of a disposition of our common stock or Warrants paid to foreign financial institutions or non-financial foreign entities.

Backup Withholding and Information Reporting

We must report annually to the IRS and to each Non-U.S. Holder the gross amount of the distributions (including constructive distributions) on our common stock or Warrants paid to such holder and the tax withheld, if any, with respect to such distributions. Non-U.S. Holders may have to comply with specific certification procedures to establish that the holder is not a U.S. person (as defined in the Code) in order to avoid backup withholding at the applicable rate, currently 24%, with respect to dividends (or constructive dividends) on our common stock or Warrants. Generally, a holder will comply with such procedures if it provides a properly executed IRS Form W-8BEN (or other applicable Form W-8) or otherwise meets documentary evidence requirements for establishing that it is a Non-U.S. Holder, or otherwise establishes an exemption. Dividends paid to Non-U.S. Holders subject to withholding of U.S. federal income tax, as described above under the heading "Dividends," will generally be exempt from U.S. backup withholding.

Information reporting and backup withholding generally will apply to the proceeds of a disposition of our common stock or Warrants by a Non-U.S. Holder effected by or through the U.S. office of any broker, U.S. or foreign, unless the holder certifies its status as a Non-U.S. Holder and satisfies certain other requirements, or otherwise establishes an exemption. Generally, information reporting and backup withholding will not apply to a payment of disposition proceeds to a Non-U.S. Holder where the transaction is effected outside the United States through a non-U.S. office of a broker. However, for information reporting purposes, dispositions effected through a non-U.S. office of a broker with substantial U.S. ownership or operations generally will be treated in a manner similar to dispositions effected through a U.S. office of a broker. Non-U.S. Holders should consult their own tax advisors regarding the application of the information reporting and backup withholding rules to them.

Copies of information returns may be made available to the tax authorities of the country in which the Non-U.S. Holder resides or is incorporated under the provisions of a specific treaty or agreement.

Backup withholding is not an additional tax. Any amounts withheld under the backup withholding rules from a payment to a Non-U.S. Holder can be refunded or credited against the Non-U.S. Holder's U.S. federal income tax liability, if any, provided that an appropriate claim is timely filed with the IRS.

Foreign Accounts

The Foreign Account Tax Compliance Act, or FATCA, generally imposes a 30% withholding tax on dividends (including constructive dividends) on, and gross proceeds from the sale or other disposition of, our common stock and Warrants if paid to a non-U.S. entity unless (i) if the non-U.S. entity is a "foreign financial institution," the non-U.S. entity undertakes certain due diligence, reporting, withholding, and certification obligations, (ii) if the non-U.S. entity is not a "foreign financial institution," the non-U.S. entity identifies certain of its U.S. investors, if any, or (iii) the non-U.S. entity is otherwise exempt under FATCA.

Withholding under FATCA generally applies to payments of dividends (including constructive dividends) on our common stock and Warrants. While withholding under FATCA may apply to payments of gross proceeds from a sale or other disposition of our common stock or Warrants, under recently proposed U.S. Treasury Regulations, withholding on payments of gross proceeds is not required. Although such regulations are not final, applicable withholding agents may rely on the proposed regulations until final regulations are issued.

An intergovernmental agreement between the United States and an applicable foreign country may modify the requirements described in this section. Under certain circumstances, a holder may be eligible for refunds or credits of the tax. Holders should consult their own tax advisors regarding the possible implications of FATCA on their investment in our common stock or Warrants.

Federal Estate Tax

Common stock owned or treated as owned by an individual who is not a citizen or resident of the United States (as specially defined for U.S. federal estate tax purposes) at the time of death will be included in the individual's gross estate for U.S. federal estate tax purposes and, therefore, may be subject to U.S. federal estate tax, unless an applicable estate tax or other treaty provides otherwise. The foregoing may also apply to Warrants. A Non-U.S. Holder should consult his, her, or its own tax advisor regarding the U.S. federal estate tax consequences of the ownership or disposition of shares of our common stock and Warrants.

The preceding discussion of material U.S. federal tax considerations is for information only. It is not tax advice. Prospective investors should consult their own tax advisors regarding the particular U.S. federal, state, local and non-U.S. tax consequences of purchasing, holding and disposing of our common stock or Warrants, including the consequences of any proposed changes in applicable laws.

PLAN OF DISTRIBUTION

In accordance with the terms of the warrants, or the Warrants, to purchase the shares of our common stock we are offering in this offering, we will issue such shares to the holders of such warrants upon due exercise of the Warrants. No underwriter or other person has been engaged by us to facilitate the sale of the shares of our common stock we are offering in this offering. We will receive all of the proceeds from any cash exercise of the Warrants. All costs associated with this registration were borne by us.

Each Warrant has an exercise price of \$6.25 per share, is exercisable in full and will expire on the fifth anniversary the original issuance date. The exercise price and number of shares of common stock issuable upon exercise is subject to appropriate adjustment in the event of stock dividends, stock splits, reorganizations or similar events affecting our common stock and the exercise price.

If, at the time a holder exercises its Warrants, a registration statement registering the issuance of the shares of common stock underlying the Warrants under the Securities Act of 1933, as amended, is not then effective or available for the issuance of such shares, then in lieu of making the cash payment otherwise contemplated to be made to us upon such exercise in payment of the aggregate exercise price, the holder may elect instead to receive upon such exercise (either in whole or in part) the net number of shares of common stock determined according to a formula set forth in the Warrants.

The Warrants are exercisable, at the option of each holder, in whole or in part, by delivering to us a duly executed exercise notice accompanied by payment in full for the number of shares of our common stock purchased upon such exercise (except in the case of a cashless exercise as discussed above). A holder (together with its affiliates) may not exercise any portion of a Warrant to the extent that the holder would own more than 4.99% of the outstanding common stock immediately after exercise, except that upon at least 61 days' prior notice from the holder to us, the holder may increase the amount of ownership of outstanding stock after exercising the holder's Warrants up to 9.99% of the number of shares of our common stock outstanding immediately after giving effect to the exercise, as such percentage ownership is determined in accordance with the terms of the Warrants. Purchasers of Warrants were also able to elect prior to the issuance of Warrants to have the initial exercise limitation set at 9.99% of our outstanding common stock.

No fractional shares of common stock will be issued upon the exercise of the Warrants. Rather, the number of shares of common stock to be issued will be rounded to the nearest whole number.

LEGAL MATTERS

The validity of the securities offered hereby will be passed upon for us by Wilmer Cutler Pickering Hale and Dorr LLP, Boston, Massachusetts.

EXPERTS

Ernst & Young, LLP, independent registered public accounting firm, has audited our consolidated financial statements included in our [Annual Report on Form 10-K for the year ended December 31, 2018](#), as set forth in their report, which is incorporated by reference in this prospectus and elsewhere in the registration statement. Our financial statements are incorporated by reference in reliance on Ernst & Young LLP's report, given on their authority as experts in accounting and auditing.

WHERE YOU CAN FIND MORE INFORMATION

We file annual, quarterly and current reports, proxy statements and other information with the SEC. Our SEC filings are available to the public over the Internet at the SEC's website at <http://www.sec.gov>. Copies of certain information filed by us with the SEC are also available on our website at www.catabasis.com. Our website is not a part of this prospectus and is not incorporated by reference in this prospectus.

This prospectus is part of a registration statement we filed with the SEC. This prospectus omits some information contained in the registration statement in accordance with SEC rules and regulations. You should review the information and exhibits in the registration statement for further information about us and our consolidated subsidiary and the securities we are offering. Statements in this prospectus concerning any document we filed as an exhibit to the registration statement or that we otherwise filed with the SEC are not intended to be comprehensive and are qualified by reference to these filings. You should review the complete document to evaluate these statements.

INCORPORATION BY REFERENCE

The SEC allows us to incorporate by reference much of the information we file with the SEC, which means that we can disclose important information to you by referring you to those publicly available documents. The information that we incorporate by reference in this prospectus is considered to be part of this prospectus. Because we are incorporating by reference future filings with the SEC, this prospectus is continually updated and those future filings may modify or supersede some of the information included or incorporated in this prospectus. This means that you must look at all of the SEC filings that we incorporate by reference to determine if any of the statements in this prospectus or in any document previously incorporated by reference have been modified or superseded. This prospectus incorporates by reference the documents listed below (File No. 001-37467) and any future filings we make with the SEC under Sections 13(a), 13(c), 14 or 15(d) of the Securities Exchange Act of 1934, as amended, or the Exchange Act (in each case, other than those documents or the portions of those documents not deemed to be filed) between the date of the initial registration statement and the effectiveness of the registration statement and following the effectiveness of the registration statement until the offering of the securities under the registration statement is terminated or completed:

- [Annual Report on Form 10-K for the fiscal year ended December 31, 2018](#), including the information specifically incorporated by reference into the Annual Report on Form 10-K from our [definitive proxy statement for the 2019 Annual Meeting of Stockholders](#);
- Quarterly Report on Form 10-Q for the quarterly period ended March 31, 2019;
- Current Reports on Form 8-K filed [January 9, 2019](#), [February 6, 2019](#), [February 14, 2019](#); and

- [The description of our common stock contained in our Registration Statement on Form 8-A filed on June 23, 2015, including any amendments or reports filed for the purpose of updating such description.](#)

You may request a copy of these filings, at no cost, by writing or telephoning us at the following address or telephone number:

Catabasis Pharmaceuticals, Inc.
One Kendall Square
Building 1400E, Suite B14202
Cambridge, MA 02139
Attn: Investor Relations
(617) 349-1971

SA-26

CATABASIS PHARMACEUTICALS, INC.

**1,997,000 Shares of Common Stock Underlying Previously
Issued Warrants**

PROSPECTUS

, 2019

The information in this prospectus is not complete and may be changed. We may not sell these securities until the registration statement filed with the Securities and Exchange Commission is effective. This prospectus is not an offer to sell these securities and we are not soliciting offers to buy these securities in any jurisdiction where the offer or sale is not permitted.

Subject to completion, dated May 14, 2019

PROSPECTUS

CATABASIS PHARMACEUTICALS, INC.

Up to \$50,000,000

Common Stock

We have entered into a sales agreement with Cowen and Company, LLC, or Cowen, dated May 14, 2019, relating to the sale of shares of our common stock, \$0.001 par value per share, offered by this prospectus. In accordance with the terms of the sales agreement, under this prospectus we may offer and sell shares of our common stock having an aggregate offering price of up to \$50,000,000 from time to time through Cowen, acting as our agent.

Our common stock is listed on the Nasdaq Global Market under the symbol "CATB." On May 10, 2019, the last reported sale price of our common stock on the Nasdaq Global Market was \$7.51 per share.

Sales of our common stock, if any, under this prospectus will be made by any method permitted that is deemed an "at the market offering" as defined in Rule 415(a)(4) under the Securities Act of 1933, as amended, or the Securities Act. Cowen is not required to sell any specific amount, but will act as our sales agent using commercially reasonable efforts consistent with its normal trading and sales practices and applicable state and federal laws, rules and regulations and the rules of the Nasdaq Stock Market, LLC. There is no arrangement for funds to be received in any escrow, trust or similar arrangement.

Cowen will be entitled to compensation at a commission rate equal to 3.0% of the gross sales price per share sold under the sales agreement. See "Plan of Distribution" beginning on page SB-15 for additional information regarding the compensation to be paid to Cowen. In connection with the sale of the common stock on our behalf, Cowen will be deemed to be an "underwriter" within the meaning of the Securities Act and the compensation of Cowen will be deemed to be underwriting commissions or discounts. We have also agreed to provide indemnification and contribution to Cowen with respect to certain liabilities, including liabilities under the Securities Act.

We are an "emerging growth company" as that term is used in the Jumpstart Our Business Startups Act of 2012 and, as such, have elected to comply with certain reduced public company reporting requirements.

Investing in these securities involves risks. See "Risk Factors" on page SB-7 of this prospectus and in the documents incorporated by reference herein for a discussion of the factors you should carefully consider before deciding to purchase our common stock.

Neither the Securities and Exchange Commission nor any state securities commission has approved or disapproved of these securities or passed upon the adequacy or accuracy of this prospectus. Any representation to the contrary is a criminal offense.

Cowen

The date of this prospectus is _____, 2019

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ABOUT THIS PROSPECTUS

This prospectus is part of a registration statement that we filed with the Securities and Exchange Commission, or the SEC, utilizing a "shelf" registration process. Under this shelf registration process, we may from time to time sell shares of our common stock having an aggregate offering price of up to \$250,000,000. Under this prospectus, we may from time to time sell shares of our common stock having an aggregate offering price of up to \$50,000,000, at prices and on terms to be determined by market conditions at the time of the offering. The \$50,000,000 of shares of our common stock that may be sold under this prospectus are included in the \$250,000,000 of shares of common stock that may be sold under the registration statement.

Before you invest, you should carefully read this prospectus and all information incorporated by reference herein, as well as the additional information described under "Where You Can Find More Information" on page SB-2 of this prospectus. These documents contain information you should consider when making your investment decision.

To the extent there is a conflict between the information contained in this prospectus, on the one hand, and the information contained in any document incorporated by reference in this prospectus that was filed prior to the date of this prospectus, on the other hand, you should rely on the information in this prospectus. If any statement in one of these documents is inconsistent with a statement in another document having a later date—for example, a document filed after the date of this prospectus and incorporated by reference in this prospectus—the statement in the document having the later date modifies or supersedes the earlier statement.

You should rely only on the information contained or incorporated by reference in this prospectus and in any free writing prospectuses we may provide to you in connection with this offering. We have not, and Cowen has not, authorized any other person to provide you with any information that is different. If anyone provides you with different or inconsistent information, you should not rely on it. We are offering to sell, and seeking offers to buy, shares of our common stock only in jurisdictions where offers and sales are permitted. The distribution of this prospectus and the offering of the common stock in certain jurisdictions may be restricted by law. Persons outside the United States who come into possession of this prospectus must inform themselves about, and observe any restrictions relating to, the offering of the common stock and the distribution of this prospectus outside the United States. This prospectus does not constitute, and may not be used in connection with, an offer to sell, or a solicitation of an offer to buy, any securities offered by this prospectus by any person in any jurisdiction in which it is unlawful for such person to make such an offer or solicitation.

We further note that the representations, warranties and covenants made by us in any agreement that is filed as an exhibit to any document that is incorporated by reference in this prospectus were made solely for the benefit of the parties to such agreement, including, in some cases, for the purpose of allocating risk among the parties to such agreements, and should not be deemed to be a representation, warranty or covenant to you. Moreover, such representations, warranties or covenants were accurate only as of the date when made. Accordingly, such representations, warranties and covenants should not be relied on as accurately representing the current state of our affairs.

Unless the context otherwise indicates, references in this prospectus to "we," "our" and "us" refer, collectively, to Catabasis Pharmaceuticals, Inc., a Delaware corporation, and its consolidated subsidiary.

WHERE YOU CAN FIND MORE INFORMATION

We file annual, quarterly and current reports, proxy statements and other information with the Securities and Exchange Commission, or SEC. Our SEC filings are available to the public over the Internet at the SEC's website at <http://www.sec.gov>. Copies of certain information filed by us with the SEC are also available on our website at www.catabasis.com. Our website is not a part of this prospectus and is not incorporated by reference in this prospectus.

This prospectus is part of a registration statement we filed with the SEC. This prospectus omits some information contained in the registration statement in accordance with SEC rules and regulations. You should review the information and exhibits in the registration statement for further information about us and our consolidated subsidiary and the securities we are offering. Statements in this prospectus concerning any document we filed as an exhibit to the registration statement or that we otherwise filed with the SEC are not intended to be comprehensive and are qualified by reference to these filings. You should review the complete document to evaluate these statements.

INCORPORATION BY REFERENCE

The SEC allows us to incorporate by reference much of the information we file with the SEC, which means that we can disclose important information to you by referring you to those publicly available documents. The information that we incorporate by reference in this prospectus is considered to be part of this prospectus. Because we are incorporating by reference future filings with the SEC, this prospectus is continually updated and those future filings may modify or supersede some of the information included or incorporated in this prospectus. This means that you must look at all of the SEC filings that we incorporate by reference to determine if any of the statements in this prospectus or in any document previously incorporated by reference have been modified or superseded. This prospectus incorporates by reference the documents listed below (File No. 001-37467) and any future filings we make with the SEC under Sections 13(a), 13(c), 14 or 15(d) of the Securities Exchange Act of 1934, as amended, or the Exchange Act, (in each case, other than those documents or the portions of those documents not deemed to be filed) following the effectiveness of the registration statement until the offering of the securities under the registration statement is terminated or completed:

1. our [Annual Report on Form 10-K for the year ended December 31, 2018](#), including the information specifically incorporated by reference into our Annual Report on Form 10-K for the fiscal year ended December 31, 2018 from our [definitive proxy statement on Schedule 14A filed with the SEC on April 22, 2019](#);
2. our Quarterly Reports on Form 10-Q for the quarterly period ended March 31, 2019;
3. our Current Reports on Form 8-K filed with the SEC on [January 9, 2019](#), [February 6, 2019](#), [February 14, 2019](#); and
4. [the description of our common stock contained in our Registration Statement on Form 8-A filed on June 23, 2015, including any amendments or reports filed for the purpose of updating such description](#).

You may request a copy of these filings, at no cost, by writing or telephoning us at the following address or telephone number:

Catabasis Pharmaceuticals, Inc.
One Kendall Square
Building 1400E, Suite B14202
Cambridge, MA 02139
Attn: Investor Relations
(617) 349-1971

FORWARD-LOOKING STATEMENTS

This prospectus and the information incorporated by reference in this prospectus include "forward-looking statements" within the meaning of Section 27A of the Securities Act of 1933, as amended, or the Securities Act, and Section 21E of the Exchange Act. All statements, other than statements of historical facts, contained or incorporated by reference in this prospectus, including statements regarding our strategy, future operations, future financial position, future revenue, projected costs, prospects, plans and objectives of management and expected market growth are forward-looking statements. The words "anticipate," "believe," "continue," "could," "estimate," "expect," "intend," "may," "plan," "potential," "predict," "project," "should," "target," "would" and similar expressions are intended to identify forward-looking statements, although not all forward-looking statements contain these identifying words.

These forward-looking statements include, among other things, statements about:

- our expectations regarding our ability to successfully conduct the PolarisDMD trial, and our expectations regarding the timing and results of such trial, including reporting top-line results of this trial in the second half of 2020 and the potential consistency of data produced by this trial with prior results from our MoveDMD® trial, as well as any new data and analyses relating to the safety profile and potential clinical benefits of edasalonexent;
- our expectations regarding our ability to successfully conduct the GalaxyDMD open-label extension trial, including the anticipated announcement of data from this trial;
- our plans to identify, develop and commercialize novel therapeutics based on our SMART Linker™ drug discovery platform;
- ongoing and planned clinical trials for edasalonexent and other product candidates, whether conducted by us or by any future collaborators, including the timing of initiation of these trials and the anticipated announcement of results;
- our plans to enter into collaborations for the development and commercialization of product candidates;
- the potential benefits of any future collaboration;
- our ability to receive research and development funding and achieve anticipated milestones under any future collaborations;
- the timing of and our ability to obtain and maintain regulatory approvals for our product candidates;
- the rate and degree of market acceptance and clinical utility of any products for which we receive marketing approval;
- our commercialization, marketing and manufacturing capabilities and strategy;
- our intellectual property position and strategy;
- our ability to identify additional products or product candidates with significant commercial potential;
- our estimates regarding expenses, future revenue, capital requirements and needs for additional financing;
- developments relating to our competitors and our industry; and
- the impact of government laws and regulations.

You are cautioned that these forward-looking statements are only predictions and are subject to risks, uncertainties and assumptions, including those referenced in the section of this prospectus entitled "Risk Factors" and in the sections entitled "Risk Factors" in our most recent [Annual Report on Form 10-K](#) and the other filings we make with the Securities and Exchange Commission, or the SEC, from time to time that are incorporated by reference herein. We undertake no obligation to revise or update any forward-looking statements, except to the extent required by law.

PROSPECTUS SUMMARY

About Catabasis Pharmaceuticals, Inc.

This summary highlights certain information about us, this offering and selected information contained elsewhere in or incorporated by reference into this prospectus, and the information incorporated by reference herein. This summary is not complete and does not contain all of the information that you should consider before deciding whether to invest in our common stock. For a more complete understanding of our company and this offering, we encourage you to read and consider carefully the entire prospectus, including "Risk Factors" beginning on page SB-7 of this prospectus, along with our consolidated financial statements and notes to those consolidated financial statements and the other documents incorporated by reference in this prospectus.

Overview

We are a clinical-stage biopharmaceutical company. Our lead program is edasalonexent, formerly known as CAT-1004, an oral small molecule designed to inhibit NF- κ B, or nuclear factor kappa-light-chain-enhancer of activated B cells, in development for the treatment of Duchenne muscular dystrophy, or DMD. We believe edasalonexent has the potential to be a foundational therapy for all patients affected by DMD, regardless of the underlying dystrophin mutation. DMD is an ultimately fatal genetic disorder involving progressive muscle degeneration. The United States Food and Drug Administration, or FDA, has granted orphan drug, fast track and rare pediatric disease designations to edasalonexent for the treatment of DMD. The European Commission, or EC, has granted orphan medicinal product designation to edasalonexent for the treatment of DMD.

We initiated a global Phase 3 trial of edasalonexent for the treatment of DMD in September 2018, which we refer to as the PolarisDMD trial. The PolarisDMD trial is designed to evaluate the efficacy and safety of edasalonexent for registration purposes. The PolarisDMD trial is active in seven countries and enrolling patients globally, with enrollment expected to be completed in 2019. Top-line results from the trial are expected in the second half of 2020. Our goal is to submit a New Drug Application for edasalonexent for the treatment of DMD in early 2021. The trial design was informed by discussions with the FDA, as well as input from treating physicians, families of boys affected by DMD and patient advocacy organizations.

The Phase 3 PolarisDMD trial is a randomized, double-blind, placebo-controlled trial, and we anticipate enrolling approximately 125 patients between the ages of four and seven (up to eighth birthday), regardless of mutation type, who have not been on steroids for at least six months. The primary efficacy endpoint is change in North Star Ambulatory Assessment, or NSAA, score after 12 months of treatment with edasalonexent compared to placebo. Key secondary endpoints are the age-appropriate timed function tests: time to stand, 4-stair climb and 10-meter walk/run. Assessments of growth, cardiac and bone health are also included in the trial.

Our MoveDMD Phase 1/2 trial enrolled ambulatory boys four to seven years old with a genetically confirmed diagnosis of DMD who were steroid naive or had not used steroids for at least six months prior to the trial. Boys enrolled in the trial were not limited to any specific dystrophin mutations and the 31 boys in the trial had 26 different dystrophin mutations. The MoveDMD trial was designed to be conducted in three sequential parts, Phase 1 and Phase 2, both of which are completed, and an open-label extension, which is on-going. In Phase 1 of the MoveDMD trial, we assessed the safety, tolerability and pharmacokinetics of edasalonexent in 17 patients, following seven days of dosing, and we reported in January 2016 that all three doses of edasalonexent tested were generally well tolerated with no safety signals observed and there were no serious adverse events and no drug discontinuations. In the Phase 2 portion of the trial, we assessed the effects of edasalonexent using magnetic resonance imaging, or MRI, T2 as an early biomarker at 12 weeks, and announced in January 2017 that the primary efficacy endpoint of average change from baseline to week 12 in the MRI T2 composite

measure of lower leg muscles for the pooled edasalonexent treatment groups compared to placebo was not met, although we observed directionally positive results in the 100/mg/kg/day edasalonexent treatment group that were not statistically significant. Subsequently, in the open-label extension of the MoveDMD trial, we observed improvement in the rate of change in lower leg composite MRI T2 through 72 weeks on 100 mg/kg of edasalonexent treatment compared to the off-treatment control period.

We have completed key efficacy and safety assessments from the MoveDMD trial. In the ongoing open-label extension of the MoveDMD trial through 72 weeks of oral 100 mg/kg/day edasalonexent treatment, we observed preserved muscle function and consistent improvements in all four assessments of muscle function: NSAA score, time to stand, 4-stair climb and 10-meter walk/run, compared to the rates of change in the control period for boys prior to receiving edasalonexent treatment. Additionally, supportive changes in non-effort-based measures of muscle health were seen, supporting the durability of edasalonexent treatment effects. Specifically, we observed, in the 100 mg/kg/day treatment group, that all four muscle enzymes tested (creatinase kinase, alanine aminotransferase, aspartate aminotransferase and lactate dehydrogenase) were significantly decreased compared to baseline following edasalonexent treatment at 12 weeks and later time points through 72 weeks ($p < 0.05$). Through 72 weeks of treatment, edasalonexent continued to be well tolerated with no safety signals observed in the MoveDMD trial. Boys treated with edasalonexent continued to follow age-appropriate growth curves with age-appropriate increases in weight and height and overall body mass index trended down to age-normative values. We also observed that the heart rate of the boys significantly decreased toward age-normative values with over a year and a half period of edasalonexent treatment.

In March 2019, we initiated a new open-label extension trial, which we refer to as the GalaxyDMD trial. As we complete the MoveDMD trial, all of the boys participating in the MoveDMD trial open-label extension are given the opportunity to transition to the GalaxyDMD trial. When boys complete the 12-month PolarisDMD trial, they are given the opportunity to receive open-label edasalonexent in the GalaxyDMD trial. The GalaxyDMD trial is designed to provide longer term safety data to support registration filings.

In addition to edasalonexent, we have developed CAT-5571 as a potential treatment for cystic fibrosis, or CF. CAT-5571 is an oral small molecule that is designed to activate autophagy, a mechanism for recycling cellular components and digesting pathogens, which is important for host defenses and is depressed in CF. We have completed investigational new drug, or IND, application-enabling activities for CAT-5571.

THE OFFERING

Common stock offered by us	Shares of our common stock having an aggregate offering price of up to \$50,000,000.
Common stock to be outstanding after this offering	18,154,032 shares, assuming the sale of 6,657,790 shares of our common stock in this offering at an offering price of \$7.51 per share, which was the last reported sale price of our common stock on the Nasdaq Global Market on May 10, 2019. The actual number of shares issued will vary depending on the sales price under this offering.
Manner of offering	"At the market offering" that may be made from time to time through our sales agent, Cowen and Company, LLC. See the section entitled "Plan of Distribution" on page SB-15 of this prospectus.
Use of proceeds	We currently estimate that we will use the net proceeds from this offering to fund our ongoing and planned clinical trials of edasalonexent, to fund market development activities for edasalonexent, to fund research and development to advance our pipeline, and for working capital and other general corporate purposes. See the section entitled "Use of Proceeds" on page SB-12 of this prospectus.
Risk factors	See "Risk Factors" beginning on page SB-7 of this prospectus, as well as the other information included in or incorporated by reference in this prospectus, for a discussion of certain factors you should carefully consider before deciding to invest in shares of our common stock.
Nasdaq Global Market symbol	"CATB"

The number of shares of our common stock to be outstanding after this offering is based on 11,496,242 shares of our common stock outstanding as of March 31, 2019.

The number of shares of our common stock to be outstanding after this offering excludes:

- 758,304 shares of our common stock issuable upon the exercise of stock options outstanding as of March 31, 2019 at a weighted-average exercise price of \$18.16 per share;
- 553,014 shares of our common stock available for future issuance as of March 31, 2019 under our 2015 stock incentive plan;
- 112,481 shares of our common stock available for future issuance as of March 31, 2019 under our 2015 employee stock purchase plan;
- 6,201,949 shares of our common stock that had been reserved for issuance in connection with warrants outstanding as of March 31, 2019, including the Warrants, at a weighted-average exercise price of \$10.19 per share.

Unless otherwise indicated, all information in this prospectus reflects and assumes:

- a one-for-ten reverse stock split of our common stock that was effected on December 28, 2018; and
- no exercise of the outstanding options or warrants described above.

RISK FACTORS

An investment in our common stock involves a high degree of risk. Before deciding whether to invest in our common stock, you should consider carefully the risks and uncertainties described below and under the section captioned "Risk Factors" contained in our most recent [Annual Report on Form 10-K](#) and other filings we make with the SEC from time to time, which are incorporated by reference herein in their entirety, together with other information in this prospectus and the information incorporated by reference herein and in any free writing prospectus that we may authorize for use in connection with this offering. If any of these risks actually occurs, our business, financial condition, results of operations or cash flow could suffer materially. In such event, the trading price of our common stock could decline and you might lose all or part of your investment.

Risks Related to This Offering

If you purchase shares of common stock in this offering, you will suffer immediate dilution of your investment.

The shares sold in this offering, if any, will be sold from time to time at various prices. However, the expected offering price of our common stock will be substantially higher than the net tangible book value per share of our common stock. Therefore, if you purchase shares of our common stock in this offering, you will pay a price per share that substantially exceeds our net tangible book value per share after this offering. You will experience immediate dilution of \$2.10 per share, representing the difference between our as adjusted net tangible book value per share after giving effect to the sale of 6,657,790 shares in this offering and the assumed offering price of \$7.51 per share, the last reported sale price of our common stock on The Nasdaq Global Market on May 10, 2019. To the extent outstanding options are exercised, you will incur further dilution.

You may experience future dilution as a result of future equity offerings.

In order to raise additional capital, we may in the future offer additional shares of our common stock or other securities convertible into or exchangeable for our common stock at prices that may not be the same as the price per share in this offering. We may sell shares or other securities in any other offering at a price per share that is less than the price per share paid by investors in this offering, and investors purchasing shares or other securities in the future could have rights superior to existing stockholders. The price per share at which we sell additional shares of our common stock, or securities convertible or exchangeable into common stock, in future transactions may be higher or lower than the price per share paid by investors in this offering.

We have broad discretion over the use of our cash and cash equivalents, including the net proceeds we receive in this offering, and may not use them effectively.

Our management has broad discretion to use our cash and cash equivalents, including the net proceeds we receive in this offering, to fund our operations and could spend these funds in ways that do not improve our results of operations or enhance the value of our common stock. The failure by our management to apply these funds effectively could result in financial losses that could have a material adverse effect on our business, cause the price of our common stock to decline and delay the development of our product candidates. Pending their use to fund operations, we may invest our cash and cash equivalents in a manner that does not produce income or that loses value.

DESCRIPTION OF CAPITAL STOCK

The following description of our capital stock is intended as a summary only and therefore is not a complete description of our capital stock. This description is based upon, and is qualified by reference to, our certificate of incorporation, our by-laws and applicable provisions of Delaware corporate law. You should read our certificate of incorporation and by-laws, which are filed as exhibits to the registration statement of which this prospectus forms a part, for the provisions that are important to you.

Our authorized capital stock consists of 150,000,000 shares of common stock, \$0.001 par value per share, and 5,000,000 shares of preferred stock, \$0.001 par value per share. As of March 31, 2019, 11,496,242 shares of common stock were outstanding and no shares of preferred stock were outstanding.

Common Stock

Voting Rights. Holders of our common stock are entitled to one vote for each share held on all matters submitted to a vote of stockholders, except that unless otherwise required by law, holders of our common stock are not entitled to vote on any amendment to the certificate of incorporation that relates solely to the terms of one or more outstanding series of preferred stock, if the holders of such affected series are entitled, either separately or together as a class with the holders of one or more such other series, to vote thereon pursuant to the certificate of incorporation. Holders of our common stock do not have cumulative voting rights.

An election of directors will be decided by a plurality of the votes cast by the stockholders entitled to vote on the election at a duly held stockholders' meeting at which a quorum is present. All other questions will be decided by a majority of the votes cast by stockholders entitled to vote thereon at a duly held meeting of stockholders at which a quorum is present, except when a different vote is required by law, our certificate of incorporation or by-laws.

Dividends. Holders of common stock are entitled to receive proportionately any dividends as may be declared by our board of directors, subject to any preferential dividend or other rights of any series of preferred stock that we may designate and issue in the future.

Liquidation and Dissolution. In the event of our liquidation or dissolution, the holders of common stock are entitled to receive proportionately our net assets available for distribution to stockholders after the payment of all debts and other liabilities and subject to the prior rights of any outstanding preferred stock.

Other Rights. Holders of common stock have no preemptive, subscription, redemption or conversion rights. The rights, preferences and privileges of holders of common stock are subject to and may be adversely affected by the rights of the holders of shares of any series of preferred stock that we may designate and issue in the future.

Transfer Agent and Registrar. The transfer agent and registrar for our common stock is American Stock Transfer & Trust Company, LLC.

Listing on The Nasdaq Global Market. Our common stock is listed on The Nasdaq Global Market under the symbol "CATB."

Preferred Stock

We currently have no outstanding shares of preferred stock. Under our restated certificate of incorporation, we are authorized to issue "blank check" preferred stock, which may be issued in one or more series upon authorization of our board of directors. Our board of directors is authorized to fix

the designation of the series, the number of authorized shares of the series, dividend rights and terms, conversion rights, voting rights, redemption rights and terms, liquidation preferences and any other rights, powers, preferences and limitations applicable to each series of preferred stock. The authorized shares of our preferred stock are available for issuance without further action by our stockholders, unless such action is required by applicable law or the rules of any stock exchange on which our securities may be listed. If the approval of our stockholders is not required for the issuance of shares of our preferred stock, our board may determine not to seek stockholder approval.

A series of our preferred stock could, depending on the terms of such series, impede the completion of a merger, tender offer or other takeover attempt. Our board of directors will make any determination to issue preferred shares based upon its judgment as to the best interests of our stockholders. Our directors, in so acting, could issue preferred stock having terms that could discourage an acquisition attempt through which an acquirer may be able to change the composition of our board of directors, including a tender offer or other transaction that some, or a majority, of our stockholders might believe to be in their best interests or in which stockholders might receive a premium for their stock over the then-current market price of the stock.

Stock Options

As of March 31, 2019, options to purchase 758,304 shares of our common stock at a weighted-average exercise price of \$18.16 per share were outstanding, of which options to purchase 197,643 shares of our common stock were exercisable, at a weighted-average exercise price of \$46.85 per share.

Warrants

As of March 31, 2019, we had outstanding warrants to purchase shares of our common stock exercisable for an aggregate of 6,201,949 shares of our common stock at a weighted-average exercise price of \$10.19 per share.

Registration Rights

Our second amended and restated investor rights agreement, or the Investor Rights Agreement, provides certain holders of our preferred stock, including some of our directors and 5% stockholders and their respective affiliates and entities affiliated with our officers and directors, the right to require us to file registration statements under the Securities Act covering their shares or to include their shares in registration statements that we may file for ourselves or other stockholders. In addition, the holders of warrants to purchase shares of our preferred stock have rights under those warrants to become party to the Investor Rights Agreement following exercise of the warrants, following which they will have, with respect to the shares acquired on exercise of the warrants, the same rights to require us to register the shares as the other investor parties to the Investor Rights Agreement. After registration pursuant to these rights, these shares will become freely tradable without restriction under the Securities Act in the public market, subject to volume limitations applicable to affiliates.

Demand Registration Rights. Subject to specified limitations set forth in the Investor Rights Agreement, at any time the holders of a majority of then outstanding registrable securities, as defined in the Investor Rights Agreement, acting together, may demand in writing that we register their registrable securities under the Securities Act so long as the total amount of registrable shares requested to be registered has an anticipated aggregate offering price to the public, net of selling expenses, of least \$10.0 million. We are not obligated to file a registration statement pursuant to this demand provision on more than two occasions, subject to specified exceptions.

In addition, at any time when we are eligible to file a registration statement on Form S-3 under the Securities Act, subject to specified limitations, the holders of at least 35% of the registrable securities then outstanding may demand in writing that we register on Form S-3 registrable shares held

by them so long as the total amount of registrable shares requested to be registered has an anticipated aggregate offering price to the public, net of selling expenses, of least \$1.0 million.

Incidental Registration Rights. If we propose to file a registration statement to register any of our securities under the Securities Act, either for our own account or for the account of any of our stockholders that are not holders of registrable shares, solely for cash and on a form that would also permit the registration of registrable shares, the holders of our registrable shares are entitled to notice of registration and, subject to specified exceptions, we will be required to register the registrable shares then held by them that they request that we register.

Expenses. Pursuant to the Investor Rights Agreement, we are required to pay all registration expenses, including registration fees, printing expenses, fees and disbursements of our counsel and accountants and reasonable fees and disbursements of one counsel representing the selling stockholders, other than any underwriting discounts and commissions, related to any demand or incidental registration. The Investor Rights Agreement contains customary cross-indemnification provisions, pursuant to which we are obligated to indemnify the selling stockholders in the event of material misstatements or omissions in the registration statement attributable to us, and they are obligated to indemnify us for material misstatements or omissions in the registration statement attributable to them.

Provisions of Our Certificate of Incorporation and By-laws and Delaware Law That May Have Anti-Takeover Effects

Delaware law, our certificate of incorporation and our by-laws contain provisions that could have the effect of delaying, deferring or discouraging another party from acquiring control of us. These provisions, which are summarized below, are expected to discourage coercive takeover practices and inadequate takeover bids. These provisions are also designed to encourage persons seeking to acquire control of us to first negotiate with our board of directors.

Staggered Board; Removal of Directors. Our certificate of incorporation and by-laws divide our board of directors into three classes with staggered three-year terms. In addition, a director is only able to be removed for cause and only by the affirmative vote of the holders of at least 75% of the votes that all of our stockholders would be entitled to cast in an annual election of directors. Any vacancy on our board of directors, including a vacancy resulting from an enlargement of our board of directors, is only able to be filled by vote of a majority of our directors then in office. The classification of our board of directors and the limitations on the removal of directors and filling of vacancies could make it more difficult for a third party to acquire, or discourage a third party from seeking to acquire, control of our company.

Stockholder Action by Written Consent; Special Meetings. Our certificate of incorporation provides that any action required or permitted to be taken by our stockholders must be effected at a duly called annual or special meeting of our stockholders and may not be effected by any consent in writing by our stockholders. Our certificate of incorporation and by-laws also provide that, except as otherwise required by law, special meetings of our stockholders can only be called by our chairman of the board, our chief executive officer or our board of directors.

Advance Notice Requirements for Stockholder Proposals. Our by-laws establish an advance notice procedure for stockholder proposals to be brought before an annual meeting of stockholders, including proposed nominations of persons for election to our board of directors. Stockholders at an annual meeting are only able to consider proposals or nominations specified in the notice of meeting or brought before the meeting by or at the direction of our board of directors or by a stockholder of record on the record date for the meeting who is entitled to vote at the meeting and who has delivered timely written notice in proper form to our secretary of the stockholder's intention to bring such

business before the meeting. These provisions could have the effect of delaying until the next stockholder meeting stockholder actions that are favored by the holders of a majority of our outstanding voting securities.

Delaware Business Combination Statute. We are subject to Section 203 of the General Corporation Law of the State of Delaware. Subject to certain exceptions, Section 203 prevents a publicly held Delaware corporation from engaging in a "business combination" with any "interested stockholder" for three years following the date that the person became an interested stockholder, unless the interested stockholder attained such status with the approval of our board of directors or unless the business combination is approved in a prescribed manner. A "business combination" includes, among other things, a merger or consolidation involving us and the "interested stockholder" and the sale of more than 10% of our assets. In general, an "interested stockholder" is any entity or person beneficially owning 15% or more of our outstanding voting stock and any entity or person affiliated with or controlling or controlled by such entity or person.

Amendment of Certificate of Incorporation and By-laws. The General Corporation Law of the State of Delaware provides generally that the affirmative vote of a majority of the shares entitled to vote on any matter is required to amend a corporation's certificate of incorporation or by-laws, unless a corporation's certificate of incorporation or by-laws, as the case may be, requires a greater percentage. Our by-laws may be amended or repealed by a majority vote of our board of directors or by the affirmative vote of the holders of at least 75% of the votes that all of our stockholders would be entitled to cast in any annual election of directors. In addition, the affirmative vote of the holders of at least 75% of the votes that all of our stockholders would be entitled to cast in any annual election of directors is required to amend or repeal or to adopt any provisions inconsistent with any of the provisions of our certificate of incorporation described above under "*Staggered Board; Removal of Directors*" and "*Stockholder Action by Written Consent; Special Meetings*."

Exclusive Forum Selection. Our certificate of incorporation provides that, unless we consent in writing to the selection of an alternative forum, the Court of Chancery of the State of Delaware (or if the Court of Chancery does not have jurisdiction, the federal district court for the District of Delaware) shall be the sole and exclusive forum for (1) any derivative action or proceeding brought on behalf of our company, (2) any action asserting a claim of breach of a fiduciary duty owed by any of our directors, officers or employees to our company or our stockholders, (3) any action asserting a claim against our company arising pursuant to any provision of the General Corporation Law of the State of Delaware or our certificate of incorporation or by-laws, or (4) any action asserting a claim against our company governed by the internal affairs doctrine. Although our certificate of incorporation contains the choice of forum provision described above, it is possible that a court could rule that such a provision is inapplicable for a particular claim or action or that such provision is unenforceable.

Authorized but Unissued Shares. Our authorized but unissued shares of common stock and preferred stock are available for future issuance without stockholder approval, subject to any limitations imposed by the listing requirements of the Nasdaq Global Market. These additional shares may be used for a variety of corporate finance transactions, acquisitions and employee benefit plans. The existence of authorized but unissued and unreserved common stock and preferred stock could make it more difficult or discourage an attempt to obtain control of us by means of a proxy contest, tender offer, merger or otherwise.

USE OF PROCEEDS

We may issue and sell shares of our common stock having aggregate gross sales proceeds of up to \$50,000,000 from time to time (before deducting sales agent commissions and expenses) Because there is no minimum offering amount required as a condition to close this offering, the actual total public offering amount, commissions and proceeds to us, if any, are not determinable at this time.

We intend to use the net proceeds from this offering to fund our ongoing and planned clinical trials of edasalonexent, to fund market development activities for edasalonexent, to fund research and development to advance our pipeline, and for working capital and other general corporate purposes. General corporate purposes may include research and development expenditures, repayment and refinancing of debt, and working capital and capital expenditures. We have not determined the amount of net proceeds to be used specifically for such purposes. As a result, management will retain broad discretion over the allocation of the net proceeds.

DIVIDEND POLICY

We have never declared or paid any cash dividends on our capital stock. We currently intend to retain earnings, if any, to finance the growth and development of our business. We do not intend to pay cash dividends in respect of our common stock in the foreseeable future. Payment of future dividends, if any, will be at the discretion of our board of directors and will depend on our financial condition, results of operations, capital requirements, restrictions contained in current or future financing instruments, provisions of applicable law and other factors the board deems relevant.

DILUTION

If you invest in our common stock, your interest will be diluted to the extent of the difference between the price per share you pay in this offering and the net tangible book value per share of our common stock immediately after this offering. Our net tangible book value as of March 31, 2019 was approximately \$49.9 million, or approximately \$4.34 per share of common stock based upon 11,496,242 shares outstanding. Net tangible book value per share is equal to our total tangible assets, less our total liabilities, divided by the total number of shares outstanding as of March 31, 2019.

After giving effect to the sale of the 6,657,790 shares of our common stock that may be sold in this offering at an assumed offering price of \$7.51 per share, the last reported sale price of our common stock on The Nasdaq Global Market on May 10, 2019, and after deducting commissions and estimated offering expenses payable by us, our as adjusted net tangible book value as of March 31, 2019 would have been \$98.2 million, or \$5.41 per share of common stock. This represents an immediate increase in net tangible book value of \$1.07 per share to our existing stockholders and an immediate dilution of \$2.10 per share to new investors in this offering. The following table illustrates this calculation on a per share basis. The as adjusted information is illustrative only and will adjust based on the actual price to the public, the actual number of shares sold and other terms of the offering determined at the time shares of our common stock are sold pursuant to this prospectus. The as adjusted information assumes that all of the \$50,000,000 aggregate offering amount of our common stock that may be sold in this offering is sold at the assumed offering price of \$7.51 per share, the last reported sale price of our common stock on The Nasdaq Global Market on May 10, 2019. The shares sold in this offering, if any, will be sold from time to time at various prices.

Assumed offering price per share	\$ 7.51
Net tangible book value per share as of March 31, 2019	\$ 4.34
Increase in net tangible book value per share attributable to the offering	\$ 1.07
As adjusted net tangible book value per share after giving effect to the offering	\$ 5.41
Dilution per share to new investors participating in the offering	\$ 2.10

The number of shares of our common stock to be outstanding immediately after this offering is based on 11,496,242 shares of our common stock outstanding as of March 31, 2019. The number of shares outstanding as of March 31, 2019 excludes:

- 758,304 shares of our common stock issuable upon the exercise of stock options outstanding as of March 31, 2019, at a weighted-average exercise price of \$18.16 per share;
- 553,014 shares of our common stock available for future issuance as of March 31, 2019 under our 2015 stock incentive plan;
- 6,201,949 shares of our common stock issuable upon the exercise of warrants outstanding as of March 31, 2019, at a weighted-average exercise price of \$10.19 per share; and
- 112,481 shares of our common stock available for future issuance as of March 31, 2019 under our 2015 employee stock purchase plan.

PLAN OF DISTRIBUTION

We have entered into a sales agreement with Cowen, under which we may offer and sell from time to time up to an aggregate of \$50,000,000 of our common stock through Cowen as our sales agent. Sales of our common stock, if any, will be made at market prices by any method that is deemed to be an "at the market offering" as defined in Rule 415(a)(4) under the Securities Act, including sales made directly on or through The Nasdaq Global Market or on any other existing trading market for our common stock.

Cowen will offer our common stock subject to the terms and conditions of the sales agreement on a daily basis or as otherwise agreed upon by us and Cowen. We will designate the maximum amount of common stock to be sold through Cowen on a daily basis or otherwise determine such maximum amount together with Cowen. Subject to the terms and conditions of the sales agreement, Cowen will use its commercially reasonable efforts to sell on our behalf all of the shares of common stock requested to be sold by us. We may instruct Cowen not to sell common stock if the sales cannot be effected at or above the price designated by us in any such instruction. Cowen or we may suspend the offering of our common stock being made through Cowen under the sales agreement upon proper notice to the other party. Cowen and we each have the right, by giving written notice as specified in the sales agreement, to terminate the sales agreement in each party's sole discretion at any time.

The aggregate compensation payable to Cowen as sales agent equals 3.0% of the gross sales price of the shares sold through it pursuant to the sales agreement. We have also agreed to reimburse Cowen in a mutually agreed amount not to exceed \$50,000 of Cowen's actual outside legal expenses incurred by Cowen in connection with this offering. We have also agreed to reimburse Cowen for its FINRA counsel fee of up to \$15,000. We estimate that the total expenses of the offering payable by us, excluding commissions payable to Cowen under the sales agreement, will be approximately \$210,000.

The remaining sales proceeds, after deducting any expenses payable by us and any transaction fees imposed by any governmental, regulatory, or self-regulatory organization in connection with the sales, will equal our net proceeds for the sale of such common stock.

Cowen will provide written confirmation to us following the close of trading on The Nasdaq Global Market on each day in which common stock is sold through it as sales agent under the sales agreement. Each confirmation will include the number of shares of common stock sold through it as sales agent on that day, the volume weighted average price of the shares sold, the percentage of the daily trading volume and the net proceeds to us.

In any quarter in which shares of common stock are sold through Cowen under the sales agreement, we will report the number of shares of common stock sold, the net proceeds to us and the compensation paid by us to Cowen in connection with the sales of common stock.

Settlement for sales of common stock will occur, unless the parties agree otherwise, on the second business day that is also a trading day following the date on which any sales were made in return for payment of the net proceeds to us. There is no arrangement for funds to be received in an escrow, trust or similar arrangement.

In connection with the sales of our common stock on our behalf, Cowen will be deemed to be an "underwriter" within the meaning of the Securities Act, and the compensation paid to Cowen will be deemed to be underwriting commissions or discounts. We have agreed in the sales agreement to provide indemnification and contribution to Cowen against certain liabilities, including liabilities under the Securities Act. As sales agent, Cowen will not engage in any transactions that stabilize our common stock.

Our common stock is listed on The Nasdaq Global Market and trades under the symbol "CATB." The transfer agent of our common stock is American Stock Transfer & Trust Company, LLC.

Cowen and its affiliates have provided, and may in the future provide, various investment banking and other financial services for us for which services they have received and, may in the future receive, customary fees.

LEGAL MATTERS

The validity of the shares of common stock offered hereby will be passed upon for us by Wilmer Cutler Pickering Hale and Dorr LLP, Boston, Massachusetts. Cowen and Company, LLC is being represented in connection with this offering by Cooley LLP, New York, New York.

EXPERTS

Ernst & Young, LLP, independent registered public accounting firm, has audited our consolidated financial statements included in our [Annual Report on Form 10-K for the year ended December 31, 2018](#), as set forth in their report, which is incorporated by reference in this prospectus and elsewhere in the registration statement. Our financial statements are incorporated by reference in reliance on Ernst & Young LLP's report, given on their authority as experts in accounting and auditing.

CATABASIS PHARMACEUTICALS, INC.

Up to \$50,000,000

Common Stock

PROSPECTUS

Cowen

, 2019

PART II
INFORMATION NOT REQUIRED IN PROSPECTUS

Item 14. Other Expenses of Issuance and Distribution.

Set forth below are estimates (except in the case of the SEC registration fee) of the amount of fees and expenses to be incurred in connection with the issuance and distribution of the offered securities, other than underwriting discounts and commissions.

SEC registration fee	\$ 24,560
Printing and engraving	\$ 5,000
Accounting services	\$ 50,000
Legal fees of registrant's counsel	\$ 50,000
Miscellaneous	\$ 15,440
Total	<u>\$ 145,000(1)</u>

- (1) These fees and expenses are calculated based on the securities offered and the number of issuances and accordingly are not estimated at this time and will be reflected in the applicable prospectus supplement.

Item 15. Indemnification of Directors and Officers.

Section 145 of the General Corporation Law of the State of Delaware ("DGCL") provides, generally, that a corporation shall have the power to indemnify any person who was or is a party or is threatened to be made a party to any threatened, pending or completed action, suit or proceeding (except actions by or in the right of the corporation) by reason of the fact that such person is or was a director, officer, employee or agent of the corporation against all expenses, judgments, fines and amounts paid in settlement actually and reasonably incurred by such person in connection with such action, suit or proceeding if such person acted in good faith and in a manner such person reasonably believed to be in or not opposed to the best interests of the corporation and, with respect to any criminal action or proceeding, had no reasonable cause to believe his or her conduct was unlawful. A corporation may similarly indemnify such person for expenses actually and reasonably incurred by such person in connection with the defense or settlement of any action or suit by or in the right of the corporation, *provided* that such person acted in good faith and in a manner he or she reasonably believed to be in or not opposed to the best interests of the corporation, and, in the case of claims, issues and matters as to which such person shall have been adjudged liable to the corporation, *provided* that a court shall have determined, upon application, that, despite the adjudication of liability but in view of all of the circumstances of the case, such person is fairly and reasonably entitled to indemnity for such expenses which such court shall deem proper.

Section 102(b)(7) of the DGCL provides, generally, that our certificate of incorporation may contain a provision eliminating or limiting the personal liability of a director to the corporation or its shareholders for monetary damages for breach of fiduciary duty as a director, *provided* that such provision may not eliminate or limit the liability of a director (i) for any breach of the director's duty of loyalty to the corporation or its shareholders, (ii) for acts or omissions not in good faith or which involve intentional misconduct or a knowing violation of law, (iii) under section 174 of the DGCL, or (iv) for any transaction from which the director derived an improper personal benefit. No such provision may eliminate or limit the liability of a director for any act or omission occurring prior to the date when such provision became effective.

Our certificate of incorporation provides that no director shall be personally liable to us or our stockholders for monetary damages for any breach of fiduciary duty as a director, notwithstanding any provision of law imposing such liability, except to the extent that the DGCL prohibits the elimination

or limitation of liability of directors for breaches of fiduciary duty. Our certificate of incorporation also provides that we will indemnify each person who was or is a party or threatened to be made a party to any threatened, pending or completed action, suit or proceeding, whether civil, criminal, administrative or investigative (other than an action by or in the right of us), by reason of the fact that he or she is or was, or has agreed to become, our director or officer, or is or was serving, or has agreed to serve, at our request as a director, officer, partner, employee or trustee of, or in a similar capacity with, another corporation, partnership, joint venture, trust or other enterprise (all such persons being referred to as an Indemnitee), or by reason of any action alleged to have been taken or omitted in such capacity, against all expenses (including attorneys' fees), judgments, fines and amounts paid in settlement actually and reasonably incurred in connection with such action, suit or proceeding and any appeal therefrom if such Indemnitee acted in good faith and in a manner he or she reasonably believed to be in, or not opposed to, our best interests, and, with respect to any criminal action or proceeding, he or she had no reasonable cause to believe his or her conduct was unlawful.

Our certificate of incorporation also provides that we will indemnify any Indemnitee who was or is a party to an action or suit by or in the right of us to procure a judgment in our favor by reason of the fact that the Indemnitee is or was, or has agreed to become, our director or officer, or is or was serving, or has agreed to serve, at our request as a director, officer, partner, employee or trustee of, or in a similar capacity with, another corporation, partnership, joint venture, trust or other enterprise, or by reason of any action alleged to have been taken or omitted in such capacity, against all expenses (including attorneys' fees) and, to the extent permitted by law, amounts paid in settlement actually and reasonably incurred in connection with such action, suit or proceeding, and any appeal therefrom, if the Indemnitee acted in good faith and in a manner he or she reasonably believed to be in, or not opposed to, our best interests, except that no indemnification shall be made with respect to any claim, issue or matter as to which such person shall have been adjudged to be liable to us, unless a court determines that, despite such adjudication but in view of all of the circumstances, he or she is entitled to indemnification of such expenses. Notwithstanding the foregoing, to the extent that any Indemnitee has been successful, on the merits or otherwise, he or she will be indemnified by us against all expenses (including attorneys' fees) actually and reasonably incurred by him or her or on his or her behalf in connection therewith. If we do not assume the defense, expenses must be advanced to an Indemnitee under certain circumstances.

We have entered into indemnification agreements with our directors and executive officers. In general, these agreements provide that we will indemnify the director or executive officer to the fullest extent permitted by law for claims arising in his or her capacity as a director or officer of our company or in connection with their service at our request for another corporation or entity. The indemnification agreements also provide for procedures that will apply in the event that a director or executive officer makes a claim for indemnification and establish certain presumptions that are favorable to the director or executive officer.

We maintain a general liability insurance policy that covers certain liabilities of our directors and officers arising out of claims based on acts or omissions in their capacities as directors or officers.

In any underwriting agreement we enter into in connection with the sale of securities being registered hereby, the underwriters will agree to indemnify, under certain conditions, us, our directors and officers (as well as certain other persons) against certain liabilities arising in connection with such offering.

Insofar as the forgoing provisions permit indemnification of directors, executive officers, or persons controlling us for liability arising under the Securities Act of 1933, as amended, or the Securities Act, we have been informed that, in the opinion of the SEC, such indemnification is against public policy as expressed in the Securities Act and is therefore unenforceable.

Item 16. Exhibits.

<u>Exhibit No.</u>	<u>Description</u>
1*	Form of Underwriting Agreement
1.1	Sales Agreement, dated May 14, 2019, by and between Catabasis Pharmaceuticals, Inc. and Cowen and Company, LLC.
4.1	Restated Certificate of Incorporation of the Registrant (incorporated by reference to Exhibit 3.1 to the Registrant's Current Report on Form 8-K (File No. 001-37467) filed with the Securities and Exchange Commission on July 1, 2015)
4.2	Certificate of Amendment to Restated Certificate of Incorporation of the Registrant (incorporated by reference to Exhibit 3.1 to the Registrant's Current Report on Form 8-K (File No. 001-37467) filed with the Securities and Exchange Commission on December 31, 2018)
4.3	Amended and Restated Bylaws of the Registrant (incorporated by reference to Exhibit 3.2 to the Registrant's Current Report on Form 8-K (File No. 001-37467) filed with the Securities and Exchange Commission on July 1, 2015)
4.4*	Form of Deposit Agreement
4.5*	Form of Warrant Agreement
4.6	Form of Common Stock Warrant (incorporated by reference to Exhibit 4.1 to the Registrant's Current Report on Form 8-K (File No. 001-37467) filed with the Securities and Exchange Commission on February 6, 2019)
4.7	Form of Common Stock Warrant (incorporated by reference to Exhibit 4.1 to the Registrant's Current Report on Form 8-K (File No. 001-37467) filed with the Securities and Exchange Commission on June 20, 2018)
4.8*	Form of Unit Agreement
5.1	Opinion of Wilmer Cutler Pickering Hale and Dorr LLP
23.1	Consent of Ernst & Young LLP, independent registered public accounting firm for the Registrant
23.2	Consent of Wilmer Cutler Pickering Hale and Dorr LLP (included in Exhibit 5.1)
24	Powers of Attorney (included in the signature pages to the Registration Statement)

* To be filed by amendment or by a Current Report on Form 8-K.

Item 17. Undertakings.

The undersigned Registrant hereby undertakes:

- (a) (1) To file, during any period in which offers or sales are being made, a post-effective amendment to this registration statement:
 - (i) to include any prospectus required by Section 10(a)(3) of the Securities Act of 1933, as amended (the "Securities Act");
 - (ii) to reflect in the prospectus any facts or events arising after the effective date of this registration statement (or the most recent post-effective amendment thereof) which, individually or in the aggregate, represent a fundamental change in the information

set forth in this registration statement. Notwithstanding the foregoing, any increase or decrease in volume of securities offered (if the total dollar value of securities offered would not exceed that which was registered) and any deviation from the low or high end of the estimated maximum offering range may be reflected in the form of prospectus filed with the Commission pursuant to Rule 424(b) if, in the aggregate, the changes in volume and price represent no more than a 20 percent change in the maximum aggregate offering price set forth in the "Calculation of Registration Fee" table in the effective registration statement; and

- (iii) to include any material information with respect to the plan of distribution not previously disclosed in this registration statement or any material change to such information in this registration statement;

provided, however, that paragraphs (a)(1)(i), (a)(1)(ii) and (a)(1)(iii) do not apply if the information required to be included in a post-effective amendment by those paragraphs is contained in reports filed with or furnished to the Commission by the Registrant pursuant to Section 13 or Section 15(d) of the Securities Exchange Act of 1934, as amended (the "Exchange Act"), that are incorporated by reference in this registration statement, or is contained in a form of prospectus filed pursuant to Rule 424(b) that is part of this registration statement.

- (2) That, for the purposes of determining any liability under the Securities Act, each such post-effective amendment shall be deemed to be a new registration statement relating to the securities offered therein, and the offering of such securities at the time shall be deemed to be the initial *bona fide* offering thereof.
- (3) To remove from registration by means of a post-effective amendment any of the securities being registered which remain unsold at the termination of the offering.
- (4) That, for the purpose of determining liability under the Securities Act to any purchaser:
 - (i) each prospectus filed by the Registrant pursuant to Rule 424(b)(3) shall be deemed to be part of the registration statement as of the date the filed prospectus was deemed part of and included in the registration statement; and
 - (ii) each prospectus required to be filed pursuant to Rule 424(b)(2), (b)(5), or (b)(7) as part of a registration statement in reliance on Rule 430B relating to an offering made pursuant to Rule 415(a)(1)(i), (vii) or (x) for the purpose of providing the information required by Section 10(a) of the Securities Act of 1933 shall be deemed to be part of and included in the registration statement as of the earlier of the date such form of prospectus is first used after effectiveness or the date of the first contract of sale of securities in the offering described in the prospectus. As provided in Rule 430B, for liability purposes of the issuer and any person that is at that date an underwriter, such date shall be deemed to be a new effective date of the registration statement relating to the securities in the registration statement to which that prospectus relates, and the offering of such securities at that time shall be deemed to be the initial *bona fide* offering thereof; *provided, however,* that no statement made in a registration statement or prospectus that is part of the registration statement or made in a document incorporated or deemed incorporated by reference into the registration statement or prospectus that is part of the registration statement will, as to a purchaser with a time of contract of sale prior to such effective date, supersede or modify any statement that was made in the registration statement or prospectus that was part of the registration statement or made in any such document immediately prior to such effective date.

- (5) That, for the purpose of determining liability of the Registrant under the Securities Act to any purchaser in the initial distribution of the securities, the undersigned Registrant undertakes that in a primary offering of securities of the undersigned Registrant pursuant to this registration statement, regardless of the underwriting method used to sell the securities to the purchaser, if the securities are offered or sold to such purchaser by means of any of the following communications, the undersigned Registrant will be a seller to the purchaser and will be considered to offer or sell such securities to such purchaser:
- (i) any preliminary prospectus or prospectus of the undersigned Registrant relating to the offering required to be filed pursuant to Rule 424;
 - (ii) any free writing prospectus relating to the offering prepared by or on behalf of the undersigned Registrant or used or referred to by the undersigned Registrant;
 - (iii) the portion of any other free writing prospectus relating to the offering containing material information about the undersigned Registrant or its securities provided by or on behalf of the undersigned Registrant; and
 - (iv) any other communication that is an offer in the offering made by the undersigned Registrant to the purchaser.
- (6) That, for purposes of determining any liability under the Securities Act:
- (i) the information omitted from the form of prospectus filed as part of the registration statement in reliance upon Rule 430A and contained in the form of prospectus filed by the Registrant pursuant to Rule 424(b)(1) or (4) or 497(h) under the Securities Act shall be deemed to be part of the registration statement as of the time it was declared effective; and
 - (ii) each post-effective amendment that contains a form of prospectus shall be deemed to be a new registration statement relating to the securities offered therein, and the offering of such securities at that time shall be deemed to be the initial *bona fide* offering thereof.
- (b) The undersigned Registrant hereby undertakes that, for purposes of determining any liability under the Securities Act, each filing of the Registrant's annual report pursuant to Section 13(a) or 15(d) of the Exchange Act (and, where applicable, each filing of an employee benefit plan's annual report pursuant to Section 15(d) of the Exchange Act) that is incorporated by reference in this registration statement shall be deemed to be a new registration statement relating to the securities offered therein, and the offering of such securities at that time shall be deemed to be the initial *bona fide* offering thereof.
- (c) Insofar as indemnification for liabilities arising under the Securities Act may be permitted to directors, officers and controlling persons of the Registrant pursuant to the indemnification provisions described herein, or otherwise, the Registrant has been advised that in the opinion of the Commission such indemnification is against public policy as expressed in the Securities Act and is, therefore, unenforceable. In the event that a claim for indemnification against such liabilities (other than the payment by the Registrant of expenses incurred or paid by a director, officer or controlling person of the Registrant in the successful defense of any action, suit or proceeding) is asserted by such director, officer or controlling person in connection with the securities being registered, the Registrant will, unless in the opinion of its counsel the matter has been settled by controlling precedent, submit to a court of appropriate jurisdiction the question whether such indemnification by it is against public policy as expressed in the Securities Act and will be governed by the final adjudication of such issue.

SIGNATURES

Pursuant to the requirements of the Securities Act of 1933, as amended, the Registrant certifies that it has reasonable grounds to believe that it meets all of the requirements for filing on Form S-3 and has duly caused this Registration Statement to be signed on its behalf by the undersigned, thereunto duly authorized, in the city of Cambridge, Commonwealth of Massachusetts, on this 14th day of May 2019.

CATABASIS PHARMACEUTICALS, INC.

By: /s/ JILL C. MILNE

Name: Jill C. Milne, Ph.D.
Title: *President and Chief Executive Officer*

SIGNATURES AND POWER OF ATTORNEY

We, the undersigned officers and directors of Catabasis Pharmaceuticals, Inc. hereby severally constitute and appoint Jill C. Milne and Deirdre A. Cunnane, and each of them singly, our true and lawful attorneys with full power to any of them, and to each of them singly, to sign for us and in our names in the capacities indicated below the Registration Statement on Form S-3 filed herewith and any and all amendments (including post-effective amendments) to said Registration Statement, and any registration statement filed pursuant to Rule 462 under the Securities Act of 1933, as amended, in connection with said Registration Statement, and to file or cause to be filed the same, with all exhibits thereto and other documents in connection therewith, with the Securities and Exchange Commission, and generally to do all such things in our name and on our behalf in our capacities as officers and directors to enable Catabasis Pharmaceuticals, Inc. to comply with the provisions of the Securities Act of 1933, as amended, and all requirements of the Securities and Exchange Commission, hereby ratifying and confirming all that said attorneys, and each of them, or their substitute or substitutes, shall do or cause to be done by virtue hereof.

Pursuant to the requirements of the Securities Act of 1933, as amended, this Registration Statement has been signed by the following persons in the capacities and on the dates indicated.

<u>Signature</u>	<u>Title</u>	<u>Date</u>
<hr/> /s/ JILL C. MILNE Jill C. Milne	President and Chief Executive Officer and Director (Principal Executive Officer)	May 14, 2019
<hr/> /s/ DEIRDRE A. CUNNANE Deirdre A. Cunnane	Chief Legal Officer and Treasurer (Principal Financial Officer)	May 14, 2019
<hr/> /s/ NOAH CLAUSER Noah Clauser	Vice President of Finance (Principal Accounting Officer)	May 14, 2019

<u>Signature</u>	<u>Title</u>	<u>Date</u>
<u>/s/ KENNETH BATE</u> Kenneth Bate	Chairman	May 14, 2019
<u>/s/ BURT ADELMAN</u> Burt Adelman	Director	May 14, 2019
<u>/s/ JOANNE BECK</u> Joanne Beck	Director	May 14, 2019
<u>/s/ JEAN GEORGE</u> Jean George	Director	May 14, 2019
<u>/s/ MICHAEL KISHBAUCH</u> Michael Kishbauch	Director	May 14, 2019
<u>/s/ GREGG LAPOINTE</u> Gregg Lapointe	Director	May 14, 2019

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CATABASIS PHARMACEUTICALS, INC.

\$50,000,000

COMMON STOCK

SALES AGREEMENT

May 14, 2019

Cowen and Company, LLC
599 Lexington Avenue
New York, NY 10022

Ladies and Gentlemen:

Catabasis Pharmaceuticals, Inc., a Delaware corporation (the "**Company**"), confirms its agreement (this "**Agreement**") with Cowen and Company, LLC ("**Cowen**"), as follows:

1. **Issuance and Sale of Shares.** The Company agrees that, from time to time during the term of this Agreement, on the terms and subject to the conditions set forth herein, it may issue and sell through Cowen, acting as agent and/or principal, shares (the "**Placement Shares**") of the Company's common stock, par value \$0.001 per share (the "**Common Stock**"), for an aggregate offering price of up to \$50,000,000. Notwithstanding anything to the contrary contained herein, the parties hereto agree that compliance with the limitation set forth in this **Section 1** on the number of shares of Common Stock issued and sold under this Agreement shall be the sole responsibility of the Company, and Cowen shall have no obligation in connection with such compliance. The issuance and sale of Common Stock through Cowen will be effected pursuant to the Registration Statement (as defined below) to be filed by the Company and declared effective by the Securities and Exchange Commission (the "**Commission**"), although nothing in this Agreement shall be construed as requiring the Company to use the Registration Statement (as defined below) to issue the Common Stock.

The Company has filed or will file, in accordance with the provisions of the Securities Act of 1933, as amended, and the rules and regulations thereunder (collectively, the "**Securities Act**"), with the Commission a registration statement on Form S-3, including a preliminary sales agreement prospectus (the "**Preliminary Sales Agreement Prospectus**") specifically relating to the Placement Shares, and which incorporates by reference documents that the Company has filed or will file in accordance with the provisions of the Securities Exchange Act of 1934, as amended, and the rules and regulations thereunder (collectively, the "**Exchange Act**"). The Company has furnished to Cowen, for use by Cowen, copies of the Preliminary Sales Agreement Prospectus included as part of such registration statement, and will, following the effectiveness of the Registration Statement, furnish to Cowen a final sales agreement prospectus specifically relating to the Placement Shares (the "**Final Sales Agreement Prospectus**"). Except where the context otherwise requires, such registration statement, as amended when it became effective, including all documents filed as part thereof or incorporated by reference therein, and including any information contained in a Prospectus (as defined below)

subsequently filed with the Commission pursuant to Rule 424(b) under the Securities Act or deemed to be a part of such registration statement pursuant to Rule 430B or 462(b) of the Securities Act, is herein called the “**Registration Statement**.” The Final Sales Agreement Prospectus, including all documents incorporated therein by reference, included in the Registration Statement, in the form in which such Final Sales Agreement Prospectus has most recently been filed by the Company with the Commission pursuant to Rule 424(b) under the Securities Act, together with any “issuer free writing prospectus,” as defined in Rule 433 under the Securities Act, relating to the Placement Shares that (i) is required to be filed with the Commission by the Company or (ii) is exempt from filing pursuant to Rule 433(d)(5)(i), in each case in the form filed or required to be filed with the Commission or, if not required to be filed, in the form retained in the Company’s records pursuant to Rule 433(g) (each, an “**Issuer Free Writing Prospectus**”), is herein called the “**Prospectus**.”

Any reference herein to the Registration Statement, the Prospectus or any amendment or supplement thereto shall be deemed to refer to and include the documents incorporated by reference therein, and any reference herein to the terms “amend,” “amendment” or “supplement” with respect to the Registration Statement or the Prospectus shall be deemed to refer to and include the filing after the execution hereof of any document with the Commission deemed to be incorporated by reference therein. For purposes of this Agreement, all references to the Registration Statement, the Prospectus or to any amendment or supplement thereto shall be deemed to include any copy filed with the Commission pursuant to the Electronic Data Gathering Analysis and Retrieval System (“**EDGAR**”).

2. **Placements.** Each time that the Company wishes to issue and sell Placement Shares hereunder (each, a “**Placement**”), it will notify Cowen by email notice (or other method mutually agreed to in writing by the parties) (a “**Placement Notice**”) containing the parameters in accordance with which it desires such Placement Shares to be sold, which shall at a minimum include the number of shares of Placement Shares to be issued, the time period during which sales are requested to be made, any limitation on the number of Placement Shares that may be sold in any one Trading Day (as defined in **Section 3**) and any minimum price below which sales may not be made, a form of which containing such minimum sales parameters necessary is attached hereto as **Schedule 1**. The Placement Notice shall originate from any of the individuals from the Company set forth on **Schedule 2** (with a copy to each of the other individuals from the Company listed on such schedule), and shall be addressed to each of the individuals from Cowen set forth on **Schedule 2**, as such **Schedule 2** may be amended from time to time. The Placement Notice shall be effective upon receipt by Cowen unless and until (i) in accordance with the notice requirements set forth in **Section 4**, Cowen declines to accept the terms contained therein for any reason, in its sole discretion, (ii) the entire amount of the Placement Shares thereunder have been sold, (iii) in accordance with the notice requirements set forth in **Section 4**, the Company suspends or terminates the Placement Notice for any reason, in its sole discretion, (iv) the Company issues a subsequent Placement Notice with parameters superseding those on the earlier dated Placement Notice, or (v) this Agreement has been terminated under the provisions of **Section 11**. The amount of any discount, commission or other compensation to be paid by the Company to Cowen in connection with the sale of the Placement Shares shall be calculated in accordance with the terms set forth in **Schedule 3**. It is expressly acknowledged and agreed that neither the Company nor Cowen will have any obligation whatsoever with respect to a Placement or any Placement Shares unless and until the Company delivers a Placement Notice to

Cowen and Cowen does not decline such Placement Notice pursuant to the terms set forth above, and then only upon the terms specified therein and herein. In the event of a conflict between the terms of this Agreement and the terms of a Placement Notice, the terms of the Placement Notice will control.

3. Sale of Placement Shares by Cowen. Subject to the terms and conditions herein set forth, upon the Company's delivery of a Placement Notice, and unless the sale of the Placement Shares described therein has been declined, suspended, or otherwise terminated in accordance with the terms of this Agreement, Cowen, for the period specified in the Placement Notice, will use its commercially reasonable efforts consistent with its normal trading and sales practices and applicable state and federal laws, rules and regulations and the rules of the Nasdaq Stock Market, Inc. ("**Nasdaq**") to sell such Placement Shares up to the amount specified, and otherwise in accordance with the terms of such Placement Notice. Cowen will provide written confirmation to the Company (including by email correspondence to each of the individuals of the Company set forth on Schedule 2, if receipt of such correspondence is actually acknowledged by any of the individuals to whom the notice is sent, other than via auto-reply) no later than the opening of the Trading Day (as defined below) immediately following the Trading Day on which it has made sales of Placement Shares hereunder setting forth the number of Placement Shares sold on such day, the volume-weighted average price of the Placement Shares sold, and the Net Proceeds (as defined below) payable to the Company. Cowen may sell Placement Shares by any method permitted by law deemed to be an "at the market offering" as defined in Rule 415(a)(4) under the Securities Act, including without limitation sales made through Nasdaq or on any other existing trading market for the Common Stock. Cowen shall not purchase Placement Shares for its own account as principal unless expressly authorized to do so by the Company in a Placement Notice. The Company acknowledges and agrees that (i) there can be no assurance that Cowen will be successful in selling Placement Shares, and (ii) Cowen will incur no liability or obligation to the Company or any other person or entity if it does not sell Placement Shares for any reason other than a failure by Cowen to use its commercially reasonable efforts consistent with its normal trading and sales practices to sell such Placement Shares as required under this Section 3. For the purposes hereof, "**Trading Day**" means any day on which the Company's Common Stock is purchased and sold on the principal market on which the Common Stock is listed or quoted.

4. Suspension of Sales.

(a) The Company or Cowen may, upon notice to the other party in writing (including by email correspondence to each of the individuals of the other party set forth on Schedule 2, if receipt of such correspondence is actually acknowledged by any of the individuals to whom the notice is sent, other than via auto-reply) or by telephone (confirmed immediately by verifiable facsimile transmission or email correspondence to each of the individuals of the other party set forth on Schedule 2), suspend any sale of Placement Shares; *provided, however*, that such suspension shall not affect or impair either party's obligations with respect to any Placement Shares sold hereunder prior to the receipt of such notice. Each of the parties agrees that no such notice under this Section 4 shall be effective against the other unless it is made to one of the individuals named on Schedule 2 hereto, as such schedule may be amended from time to time.

(b) Notwithstanding any other provision of this Agreement, during any period in which the Company is in possession of material non-public information, the Company and

Cowen agree that (i) no sale of Placement Shares will take place, (ii) the Company shall not request the sale of any Placement Shares, and (iii) Cowen shall not be obligated to sell or offer to sell any Placement Shares.

(c) The Registration Statement will be declared effective prior to the issuance of any Placement Notices by the Company. Notwithstanding any other provision of this Agreement, during any period in which the Registration Statement is no longer effective under the Securities Act, the Company shall promptly notify Cowen, the Company shall not request the sale of any Placement Shares, and Cowen shall not be obligated to sell or offer to sell any Placement Shares.

5. Settlement.

(a) Settlement of Placement Shares. Unless otherwise specified in the applicable Placement Notice, settlement for sales of Placement Shares will occur on the second (2nd) Trading Day following the date on which such sales are made (each, a “**Settlement Date**” and the first such settlement date, the “**First Delivery Date**”). The amount of proceeds to be delivered to the Company on a Settlement Date against receipt of the Placement Shares sold (the “**Net Proceeds**”) will be equal to the aggregate sales price received by Cowen at which such Placement Shares were sold, after deduction for (i) Cowen’s commission, discount or other compensation for such sales payable by the Company pursuant to Section 2 hereof, (ii) any other amounts due and payable by the Company to Cowen hereunder pursuant to Section 7(g) (Expenses) hereof, and (iii) any transaction fees imposed by any governmental or self-regulatory organization in respect of such sales.

(b) Delivery of Placement Shares. On or before each Settlement Date, the Company will, or will cause its transfer agent to, electronically transfer the Placement Shares being sold by crediting Cowen’s or its designee’s account (*provided* Cowen shall have given the Company written notice of such designee at least one Trading Day prior to the Settlement Date) at The Depository Trust Company through its Deposit and Withdrawal at Custodian System or by such other means of delivery as may be mutually agreed upon by the parties hereto which in all cases shall be freely tradeable, transferable, registered shares in good deliverable form. On each Settlement Date, Cowen will deliver the related Net Proceeds in same day funds to an account designated by the Company on, or prior to, the Settlement Date. The Company agrees that if the Company, or its transfer agent (if applicable), defaults in its obligation to deliver duly authorized Placement Shares on a Settlement Date through no fault of Cowen, the Company agrees that in addition to and in no way limiting the rights and obligations set forth in Section 9(a) (Indemnification and Contribution — Company Indemnification) hereto, it will (i) hold Cowen harmless against any loss, claim, damage, or reasonable and documented expense (including reasonable and documented legal fees and expenses), as incurred, arising out of or in connection with such default by the Company or its transfer agent (if applicable) and (ii) pay to Cowen (without duplication) any commission, discount, or other compensation to which it would otherwise have been entitled absent such default.

6. Representations and Warranties of the Company. The Company represents and warrants to, and agrees with, Cowen that, unless such representation, warranty or agreement specifies a different time, as of the date of this Agreement, each Representation Date (as defined

in Section 7(m)), each date on which a Placement Notice is given, and any date on which Placement Shares are sold hereunder:

(a) The Registration Statement and any registration statement filed pursuant to Rule 462(b) under the Securities Act with respect to the Registration Statement (a "**Rule 462(b) Registration Statement**") have been or will be declared effective by the Commission under the Securities Act prior to the issuance of any Placement Notices by the Company. The Company has complied to the Commission's satisfaction with all requests of the Commission for additional or supplemental information. No stop order suspending the effectiveness of the Registration Statement or any Rule 462(b) Registration Statement is in effect and no proceedings for such purpose have been instituted or are pending or, to the best knowledge of the Company, contemplated or threatened by the Commission. The Company meets the requirements for use of Form S-3 under the Securities Act. The sale of the Placement Shares hereunder meets the requirements of General Instruction I.B.1 of Form S-3 or, if applicable, General Instruction I.B.6 of Form S-3.

(b) The Prospectus when filed complied and, as amended or supplemented, if applicable, will comply in all material respects with the Securities Act. Each of the Registration Statement, any Rule 462(b) Registration Statement, the Prospectus and any post-effective amendments or supplements thereto, at the time it became effective or its date, as applicable, complied and as of each of the Settlement Dates, if any, complied in all material respects with the Securities Act and did not and, as of each Settlement Date, if any, did not and will not contain any untrue statement of a material fact or omit to state a material fact required to be stated therein or necessary to make the statements therein not misleading. The Prospectus, as amended or supplemented, as of its date, did not and, as of each of the Settlement Dates, if any, will not contain any untrue statement of a material fact or omit to state a material fact necessary in order to make the statements therein, in the light of the circumstances under which they were made, not misleading. The representations and warranties set forth in the two immediately preceding sentences do not apply to statements in or omissions from the Registration Statement, any Rule 462(b) Registration Statement, or any post-effective amendment thereto, or the Prospectus, or any amendments or supplements thereto, made in reliance upon and in conformity with information relating to Cowen furnished to the Company in writing by Cowen expressly for use therein. There are no contracts or other documents required to be described in the Prospectus or to be filed as exhibits to the Registration Statement which have not been described or filed as required.

(c) The Company has delivered to Cowen one complete copy of the Registration Statement and a copy of each consent and certificate of experts filed as a part thereof, and conformed copies of the Registration Statement (without exhibits) and the Prospectus, as amended or supplemented, in such quantities and at such places as Cowen has reasonably requested.

(d) The Company is an "emerging growth company," as defined in Section 2(a) of the Securities Act. The Company agrees to notify Cowen promptly upon the Company ceasing to be an emerging growth company.

(e) The Company has not distributed and will not distribute, prior to the completion of Cowen's distribution of the Placement Shares, any offering material in connection with the offer and sale of the Placement Shares other than the Prospectus or the Registration Statement.

(f) The Placement Shares, when issued and delivered, will be duly authorized for issuance and sale pursuant to this Agreement and, when issued and delivered by the Company against payment therefor pursuant to this Agreement, will be duly authorized, validly issued, fully paid and nonassessable.

(g) The Company has been duly incorporated and is validly existing as a corporation in good standing under the laws of the State of Delaware and has corporate power and authority to own, lease and operate its properties and to conduct its business as described in the Prospectus and to enter into and perform its obligations under this Agreement. Catabasis Securities Corporation is the Company's only significant subsidiary (as defined in Rule 1-02(w) of Regulation S-X under the Exchange Act) (the "**Significant Subsidiary**"). The Significant Subsidiary has been duly organized and is validly existing as a corporation in good standing under the laws of the jurisdiction of its organization and has the requisite power and authority to own, lease and operate its properties and to conduct its business as described in the Prospectus. Each of the Company and the Significant Subsidiary is duly qualified as a foreign corporation or foreign partnership to transact business and is in good standing in the State of Delaware and each other jurisdiction in which such qualification is required, whether by reason of the ownership or leasing of property or the conduct of business, except for such jurisdictions (other than the State of Delaware) where the failure to so qualify or to be in good standing would not reasonably be expected, individually or in the aggregate, to result in a material adverse effect on the condition (financial or otherwise), prospects, earnings, business or properties of the Company and the Subsidiary, taken as a whole, whether or not arising from transactions in the ordinary course of business (a "**Material Adverse Effect**"). Except as described in the Prospectus, all of the issued and outstanding equity interests of the Significant Subsidiary have been duly authorized and validly issued, are fully paid and nonassessable and are owned by the Company free and clear of any security interest, mortgage, pledge, lien, encumbrance or claim. The Company does not own or control, directly or indirectly, any corporation, association or other entity other than the subsidiaries listed in Exhibit 21.1 to the Company's Annual Report on Form 10-K for the most recently ended fiscal year and other than (i) those subsidiaries not required to be listed on Exhibit 21.1 by Item 601 of Regulation S-K under the Exchange Act and (ii) those subsidiaries formed since the last day of the most recently ended fiscal year.

(h) The Common Stock conforms in all material respects to the description thereof contained in the Prospectus. All of the issued and outstanding shares of Common Stock have been duly authorized and validly issued, are fully paid and nonassessable and have been issued in compliance with federal and state securities laws. None of the outstanding shares of Common Stock were issued in violation of any preemptive rights, rights of first refusal or other similar rights to subscribe for or purchase securities of the Company. There are no authorized or outstanding options, warrants, preemptive rights, rights of first refusal or other rights to purchase, or equity or debt securities convertible into or exchangeable or exercisable for, any capital stock of the Company or any of its subsidiaries other than those accurately described in all material respects in the Prospectus. The description of the Company's stock option, stock bonus and other stock plans or arrangements, and the options or other rights granted thereunder,

set forth in the Prospectus accurately and fairly presents in all material respects the information required to be shown with respect to such plans, arrangements, options and rights.

(i) At the time of filing the Registration Statement and (ii) as of the Applicable Time (with such date being used as the determination date for purposes of this clause (ii)), the Company was not and is not an Ineligible Issuer (as defined in Rule 405), without taking account of any determination by the Commission pursuant to Rule 405 that it is not necessary that the Company be considered an Ineligible Issuer.

(j) Each Issuer Free Writing Prospectus does not include any information that conflicts with the information contained in the Registration Statement, including any document incorporated by reference therein that has not been superseded or modified. The foregoing sentence does not apply to statements in or omissions from any Issuer Free Writing Prospectus based upon and in conformity with written information furnished to the Company by Cowen specifically for use therein, it being understood and agreed that the only such information furnished by or on behalf of Cowen consists of the Agent's Information.

(k) There is no franchise, contract or other document of a character required to be described in the Registration Statement or Prospectus, or to be filed as an exhibit thereto, which is not described or filed as required; and the statements in the Prospectus under the headings "Risk Factors—Risks Related to Our Intellectual Property," "Risk Factors—Risks Related to Regulatory Approval and Other Legal Compliance Matters," "Business—Intellectual Property" and "Business—Government Regulation and Product Approvals," insofar as such statements summarize legal matters, agreements, documents or proceedings discussed therein, are accurate and fair summaries of such legal matters, agreements, documents or proceedings.

(l) This Agreement has been duly authorized, executed and delivered by the Company.

(m) The Company is not, and immediately after giving effect to the offering and sale of the Placement Shares and the application of the proceeds thereof as described in the Registration Statement and the Prospectus will not be, an "investment company" as defined in the Investment Company Act of 1940, as amended (the "**Investment Company Act**").

(n) No consent, approval, authorization, filing with or order of any court or governmental agency or body is required in connection with the transactions contemplated herein, except such as have been obtained under the Securities Act and such as may be required under the blue sky laws of any jurisdiction in connection with the purchase and distribution of the Placement Shares by Cowen in the manner contemplated herein and in Registration Statement and the Prospectus.

(o) Neither the issue and sale of the Placement Shares nor the consummation of any other of the transactions contemplated herein nor the fulfillment of the terms hereof will conflict with, result in a breach or violation of, or imposition of any lien, charge or encumbrance upon any property or assets of the Company pursuant to, (i) the charter or by-laws of the Company, (ii) the terms of any indenture, contract, lease, mortgage, deed of trust, note agreement, loan agreement or other agreement, obligation, condition, covenant or instrument to which the Company is a party or bound or to which its property is subject, or (iii) any statute, law, rule, regulation, judgment, order or decree applicable to the Company of any court, regulatory body, administrative agency, governmental body, arbitrator or other authority having jurisdiction over

the Company or any of its properties, except in the case of clauses (ii) and (iii) as would not have a Material Adverse Effect or an adverse effect on the consummation of the transactions contemplated hereby.

(p) No holders of securities of the Company have rights to the registration of such securities under the Registration Statement except for such rights that have been waived.

(q) The historical financial statements and schedules of the Company included in the Prospectus and the Registration Statement present fairly in all material respects the financial condition, results of operations and cash flows of the Company as of the dates and for the periods indicated, comply as to form in all material respects with the applicable accounting requirements of the Securities Act and have been prepared in conformity with generally accepted accounting principles in the United States applied on a consistent basis throughout the periods involved (except as otherwise noted therein). The selected financial data set forth under the caption "Selected Financial Data" in the Prospectus and Registration Statement fairly present in all material respects, on the basis stated in the Prospectus and the Registration Statement, the information included therein.

(r) No action, suit or proceeding by or before any court or governmental agency, authority or body or any arbitrator involving the Company or its property is pending or, to the best knowledge of the Company, threatened that (i) could reasonably be expected to have a material adverse effect on the performance of this Agreement or the consummation of any of the transactions contemplated herein or (ii) could reasonably be expected to have a Material Adverse Effect, except as set forth in or contemplated in the Registration Statement and the Prospectus (exclusive of any supplement thereto).

(s) The Company owns or leases all such properties as are necessary to the conduct of its operations as presently conducted in all material respects.

(t) The Company is not in violation or default of (i) any provision of its charter or bylaws, (ii) the terms of any indenture, contract, lease, mortgage, deed of trust, note agreement, loan agreement or other agreement, obligation, condition, covenant or instrument to which it is a party or bound or to which its property is subject, or (iii) any statute, law, rule, regulation, judgment, order or decree of any court, regulatory body, administrative agency, governmental body, arbitrator or other authority having jurisdiction over the Company or any of its properties, except in the case of clauses (ii) and (iii), for such breach or violation as would not, individually or in the aggregate, reasonably be expected to have a Material Adverse Effect.

(u) Ernst & Young LLP, who have certified certain financial statements of the Company and delivered their report with respect to the audited financial statements and schedules included in the Registration Statement and the Prospectus, are independent public accountants with respect to the Company within the meaning of the Securities Act and the applicable published rules and regulations thereunder.

(v) There are no transfer taxes or other similar fees or charges under federal law or the laws of any state, or any political subdivision thereof, required to be paid in connection with the execution and delivery of this Agreement or the issuance by the Company or sale by the Company of the Placement Shares.

(w) The Company has filed all tax returns that are required to be filed or has requested extensions thereof (except in any case in which the failure so to file would not have a Material Adverse Effect, except as set forth in or contemplated in the Registration Statement and the Prospectus (exclusive of any supplement thereto)) and has paid all taxes required to be paid by it and any other assessment, fine or penalty levied against it, to the extent that any of the foregoing is due and payable, except for any such assessment, fine or penalty that is currently being contested in good faith or as would not have a Material Adverse Effect, except as set forth in or contemplated in the Registration Statement and the Prospectus (exclusive of any supplement thereto).

(x) No labor problem or dispute with the employees of the Company exists or, to the Company's knowledge, is threatened or imminent, and the Company is not aware of any existing or imminent labor disturbance by the employees of any of its principal suppliers, contractors or customers, that could have a Material Adverse Effect, except as set forth in or contemplated in the Registration Statement and the Prospectus (exclusive of any supplement thereto).

(y) The Company is insured by insurers of recognized financial responsibility against such losses and risks and in such amounts as the Company reasonably believes are prudent and customary in the businesses in which it is engaged; all policies of insurance and fidelity or surety bonds insuring the Company or its business, assets, employees, officers and directors are in full force and effect; the Company is in compliance with the terms of such policies and instruments in all material respects; and there are no claims by the Company under any such policy or instrument as to which any insurance company is denying liability or defending under a reservation of rights clause; the Company has not been refused any insurance coverage sought or applied for; and the Company has no reason to believe that it will not be able to renew its existing insurance coverage as and when such coverage expires or to obtain similar coverage from similar insurers as may be necessary to continue its business at a cost that would not have a Material Adverse Effect, except as set forth in or contemplated in the Registration Statement and the Prospectus (exclusive of any supplement thereto).

(z) The Company possesses all licenses, certificates, permits and other authorizations issued by all applicable authorities necessary to conduct its business, except for the lack of which would not reasonably be expected, individually or in the aggregate, to have a Material Adverse Effect, and the Company has not received any notice of proceedings relating to the revocation or modification of any such certificate, authorization or permit which, singly or in the aggregate, if the subject of an unfavorable decision, ruling or finding, would have a Material Adverse Effect, except as set forth in or contemplated in the Registration Statement and the Prospectus (exclusive of any supplement thereto).

(aa) The Company maintains a system of internal accounting controls sufficient to provide reasonable assurance that (i) transactions are executed in accordance with management's general or specific authorizations; (ii) transactions are recorded as necessary to permit preparation of financial statements in conformity with generally accepted accounting principles and to maintain asset accountability; (iii) access to assets is permitted only in accordance with management's general or specific authorization; and (iv) the recorded accountability for assets is compared with the existing assets at reasonable intervals and appropriate action is taken with respect to any differences. The Company's internal controls over financial reporting are

effective and the Company is not aware of any material weakness in its internal controls over financial reporting.

(bb) The Company maintains “disclosure controls and procedures” (as such term is defined in Rule 13a-15(e) under the Exchange Act); such disclosure controls and procedures are effective.

(cc) The Company has not taken, directly or indirectly, without giving effect to activities by Cowen, any action designed to or that would constitute or that might reasonably be expected to cause or result in, under the Exchange Act or otherwise, stabilization or manipulation of the price of any security of the Company to facilitate the sale or resale of the Placement Shares.

(dd) The documents incorporated or deemed to be incorporated by reference in the Prospectus, at the time they were or hereafter are filed with the Commission, complied and will comply in all material respects with the requirements of the Exchange Act, and, when read together with the other information in the Prospectus, at the Settlement Dates, will not contain an untrue statement of a material fact or omit to state a material fact required to be stated therein or necessary to make the fact required to be stated therein or necessary to make the statements therein, in the light of the circumstances under which they were made, not misleading.

(ee) Except in each case as would not reasonably be expected, individually or in the aggregate, to have a Material Adverse Effect, the Company is (i) in compliance with any and all applicable foreign, federal, state and local laws and regulations relating to the protection of human health and safety, the environment or hazardous or toxic substances or wastes, pollutants or contaminants (“**Environmental Laws**”), (ii) has received and is in compliance with all permits, licenses or other approvals required of it under applicable Environmental Laws to conduct its business and (iii) has not received notice of any actual or potential liability under any environmental law, except as set forth in or contemplated in the Registration Statement and the Prospectus (exclusive of any supplement thereto). Except as set forth in the Registration Statement and the Prospectus, the Company has not been named as a “potentially responsible party” under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended.

(ff) None of the following events has occurred or exists: (i) a failure to fulfill the obligations, if any, under the minimum funding standards of Section 302 of the United States Employee Retirement Income Security Act of 1974, as amended (“**ERISA**”), and the regulations and published interpretations thereunder with respect to a Plan that is required to be funded, determined without regard to any waiver of such obligations or extension of any amortization period that would reasonably be expected to have a Material Adverse Effect; (ii) an audit or investigation by the Internal Revenue Service, the U.S. Department of Labor, the Pension Benefit Guaranty Corporation or any other federal or state governmental agency or any foreign regulatory agency with respect to the employment or compensation of employees by any of the Company that would reasonably be expected to have a Material Adverse Effect; (iii) any breach of any contractual obligation, or any violation of law or applicable qualification standards, with respect to the employment or compensation of employees by the Company that would reasonably be expected to have a Material Adverse Effect. None of the following events has occurred or is reasonably likely to occur: (i) a material increase in the aggregate amount of contributions required to be made to all Plans in the current fiscal year of the Company

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compared to the amount of such contributions made in the most recently completed fiscal year of the Company; (ii) a material increase in the “accumulated post-retirement benefit obligations” (within the meaning of Statement of Financial Accounting Standards 106) of the Company compared to the amount of such obligations in the most recently completed fiscal year of the Company; (iii) any event or condition giving rise to a liability under Title IV of ERISA that would reasonably be expected to have a Material Adverse Effect; or (iv) the filing of a claim by one or more employees or former employees of the Company related to their employment that would reasonably be expected to have a Material Adverse Effect. For purposes of this paragraph, the term “**Plan**” means a plan (within the meaning of Section 3(3) of ERISA) subject to Title IV of ERISA with respect to which the Company may have any liability.

(gg) There is and has been no failure on the part of the Company and any of the Company’s directors or officers, in their capacities as such, to comply with any provision of the Sarbanes-Oxley Act of 2002 and the rules and regulations promulgated in connection therewith (the “**Sarbanes-Oxley Act**”), including Section 402 relating to loans.

(hh) Neither the Company nor, to the knowledge of the Company, any director, officer, agent, employee or affiliate of the Company is aware of or has taken any action, directly or indirectly, that would result in a violation or a sanction for violation by such persons of the Foreign Corrupt Practices Act of 1977 or the U.K. Bribery Act 2010, each as may be amended, or similar law of any other relevant jurisdiction, or the rules or regulations thereunder (collectively, “**Anti-Corruption Laws**”). The Company will not, directly or indirectly, with a corrupt or improper intention use, lend, contribute or otherwise make available, and will not direct or permit with a corrupt or improper intention any of its directors, officers, agents, employees or affiliates to use, lend, contribute or otherwise make available, the proceeds of the offering in violation of Anti-Corruption Laws. The Company has instituted and maintains policies and procedures designed to ensure compliance with Anti-Corruption Laws.

(ii) The operations of the Company are and have been conducted at all times in compliance with applicable financial recordkeeping and reporting requirements and the money laundering statutes and the rules and regulations thereunder and any related or similar rules, regulations or guidelines, issued, administered or enforced by any governmental agency (collectively, the “**Money Laundering Laws**”) and no action, suit or proceeding by or before any court or governmental agency, authority or body or any arbitrator involving the Company with respect to the Money Laundering Laws is pending or, to the knowledge of the Company, threatened.

(jj) Neither the Company nor, to the knowledge of the Company, any director, officer, agent, employee or affiliate of the Company (i) is, or is controlled or 50% or more owned by or is acting on behalf of, an individual or entity that is currently subject to any sanctions administered or enforced by the United States (including any administered or enforced by the Office of Foreign Assets Control of the U.S. Treasury Department, the U.S. Department of State, or the Bureau of Industry and Security of the U.S. Department of Commerce), the United Nations Security Council, the European Union, the United Kingdom (including sanctions administered or enforced by Her Majesty’s Treasury) or other relevant sanctions authority (collectively, “**Sanctions**”) and such persons, “**Sanctioned Persons**”), (ii) is located, organized or resident in a country or territory that is, or whose government is, the subject of Sanctions that broadly prohibit dealings with that country or territory (collectively, “**Sanctioned Countries**”) and

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each, a “**Sanctioned Country**”) or (iii) will, directly or indirectly, use the proceeds of this offering, or lend, contribute or otherwise make available such proceeds to any subsidiary, joint venture partner or other individual or entity in any manner that would result in a violation of any Sanctions by, or could result in the imposition of Sanctions against, any individual or entity (including any individual or entity participating in the offering, whether as underwriter, advisor, investor or otherwise).

(kk) Except as has been disclosed to Cowen or is not material to the analysis under any Sanctions, the Company has not engaged in any dealings or transactions with or for the benefit of a Sanctioned Person, or with or in a Sanctioned Country, in the preceding three years, nor does the Company have any plans to increase its dealings or transactions with or for the benefit of Sanctioned Persons, or with or in Sanctioned Countries.

(ll) Except as described in the Prospectus, the Company owns, possesses, licenses or has other rights to use, on reasonable terms, all patents, patent applications, trade and service marks, trade and service mark registrations, trade names, copyrights, licenses, inventions, trade secrets, technology, know-how and other intellectual property necessary for the conduct of the Company’s business in all material respects as now conducted or as proposed in the Prospectus to be conducted, in each case as described in the Prospectus (collectively, “**Company Intellectual Property**”). Except as set forth in the Prospectus, (a) there are no rights of third parties to any Company Intellectual Property, including no liens, security interests or other encumbrances; (b) to the Company’s knowledge, there is no material infringement by third parties of any Company Intellectual Property; (c) there is no pending or, to the Company’s knowledge, threatened action, suit, proceeding or claim by others challenging the Company’s rights in or to any Company Intellectual Property, and, except as would not reasonably be expected to have a Material Adverse Effect, the Company is aware of no factual basis for any such action, suit, proceeding, or claim; (d) Company Intellectual Property has not been adjudged by a court of competent jurisdiction invalid or unenforceable, in whole or in part; (e) except as would not reasonably be expected to have a Material Adverse Event, there is no pending or, to the Company’s knowledge, threatened action, suit, proceeding or claim by others challenging the validity or scope of any Company Intellectual Property, including interferences, oppositions, reexaminations, or government proceedings, and, except as would not reasonably be expected to have a Material Adverse Effect, the Company is aware of no factual basis for any such action, suit, proceeding, or claim; (f) there is no pending or, to the Company’s knowledge, threatened action, suit, proceeding or claim by others that the Company infringes, misappropriates, or otherwise violates, or would, upon the commercialization of any product or service described in the Prospectus infringe, misappropriate, or otherwise violate any patent, trademark, copyright, trade secret or other proprietary rights of others, and, except as would not reasonably be expected to have a Material Adverse Effect, the Company is aware of no factual basis for any such action, suit, proceeding, or claim; (g) to the Company’s knowledge, no employee of the Company is in or has been in violation of any term of any employment contract, patent disclosure agreement, invention assignment agreement, non-competition agreement, non-solicitation agreement, nondisclosure agreement or any restrictive covenant to or with a former employer where the basis of such violation relates to such employee’s employment with the Company; (h) to the Company’s knowledge, there is no patent or published patent application in the U.S. or other jurisdiction which, in the case of a patent, contains claims, or in the case of a published patent application contains patentable claims, that dominate or may dominate any Company Intellectual

Property described in the Prospectus as being owned by or licensed to the Company or that interferes with the issued or pending claims of any Company Intellectual Property; (i) to the Company's knowledge, there is no prior art that may render any patent held by the Company invalid or any patent application held by the Company unpatentable; and (j) all prior art of which the Company is aware that may be material to the validity of a U.S. patent or to the patentability of a U.S. patent application has been disclosed to the U.S. Patent and Trademark Office, and all such prior art has been disclosed to the patent office of other jurisdictions where required. All licenses to which the Company is a party relating to Company Intellectual Property are in full force and effect and the Company is not in violation of any term of such license.

(mm) Except as disclosed in the Registration Statement and the Prospectus, the Company (i) does not have any material lending or other relationship with any bank or lending affiliate of Cowen and (ii) does not intend to use any of the proceeds from the sale of the Placement Shares hereunder to repay any outstanding debt owed to any affiliate of Cowen.

(nn) Except as described in the Registration Statement and the Prospectus, as applicable, the Company (i) is and at all times has been in compliance with all statutes, rules and regulations applicable to the ownership, testing, development, manufacture, packaging, processing, use, distribution, marketing, advertising, labeling, promotion, sale, offer for sale, storage, import, export or disposal of any product manufactured or distributed by the Company, including, without limitation, the Federal Food, Drug and Cosmetic Act (21 U.S.C. § 301 et seq.), the federal Anti-kickback Statute (42 U.S.C. § 1320a-7b(b)), the Health Insurance Portability and Accountability Act of 1996, as amended by the Health Information Technology for Economic and Clinical Health Act of 2009, and the Patient Protection and Affordable Care Act of 2010, as amended by the Health Care and Education Affordability Reconciliation Act of 2010, the regulations promulgated pursuant to such laws, and any successor government programs, and comparable state laws, regulations relating to Good Clinical Practices, Good Laboratory Practices and Good Manufacturing Practices and all other local, state, federal, national and foreign laws, and final administrative guidance relating to the regulation of the Company (collectively, the "**Applicable Laws**"), except for such non-compliance as would not, individually or in the aggregate, have a Material Adverse Effect; (ii) has not received any written notice from any court or arbitrator or governmental or regulatory authority or third party alleging or asserting non-compliance with any Applicable Laws or any licenses, exemptions, certificates, approvals, clearances, authorizations, permits, registrations and supplements or amendments thereto required by any such Applicable Laws ("**Authorizations**"), except for such non-compliance as would not, individually or in the aggregate, have a Material Adverse Effect; (iii) possesses all material Authorizations and such Authorizations are valid and in full force and effect and is not in violation of any term of any such Authorizations, except for such violations as would not, individually or in the aggregate, have a Material Adverse Effect; (iv) has not received written notice of any claim, action, suit, proceeding, hearing, enforcement, investigation, arbitration or other action from any court or arbitrator or governmental or regulatory authority or third party alleging that any product operation or activity is in violation of any Applicable Laws or Authorizations nor, to the Company's knowledge, is any such claim, action, suit, proceeding, hearing, enforcement, investigation, arbitration or other action threatened; (v) has not received written notice that any court or arbitrator or governmental or regulatory authority has taken, is taking or intends to take action to materially limit, suspend, materially modify or revoke any Authorizations nor, to the Company's knowledge, is any such

limitation, suspension, modification or revocation threatened; (vi) has filed, obtained, maintained or submitted all material reports, documents, forms, notices, applications, records, claims, submissions and supplements or amendments as required by any Applicable Laws or Authorizations and that all such reports, documents, forms, notices, applications, records, claims, submissions and supplements or amendments were complete and accurate on the date filed in all material respects (or were corrected or supplemented by a subsequent submission); and (vii) is not a party to any corporate integrity agreements, monitoring agreements, consent decrees, settlement orders, or similar agreements with or imposed by any governmental or regulatory authority.

(oo) The clinical trials and pre-clinical studies conducted by or on behalf of or sponsored by the Company, or in which the Company has participated, that are described in the Registration Statement and the Prospectus or the results of which are referred to in the Registration Statement and the Prospectus, as applicable, and are intended to be submitted to Regulatory Authorities as a basis for product approval, were and, if still pending, are being conducted in all material respects in accordance with standard medical and scientific research procedures and all applicable statutes, rules and regulations of the United States Food and Drug Administration (the “**FDA**”) and comparable drug regulatory agencies outside of the United States to which it is subject (collectively, the “**Regulatory Authorities**”) and current Good Clinical Practices and Good Laboratory Practices; the descriptions in the Registration Statement or the Prospectus of the results of such studies and trials are accurate and complete in all material respects and fairly present the data derived from such studies and trials; the Company has no knowledge of any other studies or trials the results of which are inconsistent with or otherwise call into question the results described or referred to in the Registration Statement and the Prospectus; the Company has not received any written notices, correspondence or other communication from the Regulatory Authorities or any other governmental agency which could lead to the termination or suspension of any clinical trials or pre-clinical studies that are described in the Registration Statement and the Prospectus or the results of which are referred to in the Registration Statement or the Prospectus, and, to the Company’s knowledge, there are no reasonable grounds for same.

(pp) The Company possesses all material licenses, certificates, permits and other authorizations (collectively, “**Permits**”) issued by, and has made all declarations and filings with, the applicable federal, state, local or foreign governmental or regulatory authorities that are necessary for the ownership or lease of its properties or the conduct of its businesses as described in the Registration Statement and the Prospectus, or to permit all clinical and nonclinical studies and trials conducted by or on behalf of the Company, including, without limitation, all necessary FDA and applicable foreign regulatory agency approvals; the Company is not in violation of, or in default under, any such Permit, except for such violation or default as would not have a Material Adverse Effect; and the Company has not received notice of any revocation or modification of any such Permit and does not have any reason to believe that any such Permit will not be renewed in the ordinary course. The Company has not received any FDA Form 483, written notice of adverse finding, warning letter, untitled letter or other correspondence or written notice from any court or arbitrator or governmental or regulatory authority alleging or asserting non-compliance with (A) any Applicable Laws or (B) any Permits required by any such Applicable Laws.

(qq) To the Company's knowledge, the manufacturing facilities and operations of its suppliers are operated in compliance in all material respects with all applicable statutes, rules, regulations and policies of the Regulatory Authorities.

(rr) The Company and its subsidiaries are, and during the past three years were, in material compliance with all applicable data privacy and security laws and regulations, including without limitation the Health Insurance Portability and Accountability Act of 1996 ("**HIPAA**") (42 U.S.C. Section 1320d et seq.), as amended by the Health Information Technology for Economic and Clinical Health Act (the "**HITECH Act**") (42 U.S.C. Section 17921 et seq.); and the Company and its subsidiaries have taken reasonable actions to comply with the European Union General Data Protection Regulation ("**GDPR**") (EU 2016/679) and all other applicable data privacy and security laws and regulations that are effective as of the date hereof and for which any non-compliance with same would be reasonably likely to create a material liability (collectively, the "**Privacy Laws**"). To ensure compliance with the Privacy Laws, the Company and its subsidiaries have in place policies and procedures relating to data privacy and security and the collection, storage, use, disclosure, handling, and analysis of Personal Data (the "**Policies**") and take appropriate steps reasonably designed to ensure compliance in all material respects with such Policies. At all times since inception, where required by applicable Privacy Laws, the Company has provided accurate notice of its Policies then in effect to its customers, employees, third-party vendors and representatives. Each of the Company's notices regarding the Company's Policies (i) provides accurate and sufficient notice of the Company's then-current privacy practices relating to its subject matter; and (ii) does not contain any material omissions of the Company's then-current privacy practices relating to its subject matter. "**Personal Data**" means (i) a natural person's name, street address, telephone number, e-mail address, photograph, social security number or tax identification number, driver's license number, passport number, credit card number, bank information, or customer or account number; (ii) any information which would qualify as "personally identifying information" under the Federal Trade Commission Act, as amended; (iii) Protected Health Information as defined by HIPAA; (iv) "personal data" as defined by GDPR; and (v) any other piece of information that identifies such natural person, or his or her family, or identifies a specific person's health condition or sexual orientation. The Company further certifies that neither it nor any subsidiary: (i) has received notice of any actual or alleged violation of any of the Privacy Laws; or (ii) is a party to any order, decree, or settlement agreement that imposes any obligation or liability under any Privacy Law.

(ss) The Company and its subsidiaries' information technology assets and equipment, computers, systems, networks, hardware, software, websites, applications, and databases (collectively, "**IT Systems**") are adequate for, and operate and perform in all material respects as required in connection with the operation of the business of the Company and its subsidiaries as currently conducted, free and clear of all material bugs, errors, defects, Trojan horses, time bombs, malware and other corruptants. The Company and its subsidiaries have at all times during the past three years implemented and maintained all reasonably necessary controls, policies, procedures, and safeguards to maintain and protect their confidential information and the integrity, continuous operation, redundancy and security of all IT Systems and data (including all Personal Data, sensitive, confidential or regulated data ("**Confidential Data**")) used in connection with their businesses, and, to the Company's knowledge, there have been no

breaches, violations, outages or unauthorized uses of or accesses to same, except for those that have been remedied without material cost or liability or the duty to notify any other person.

(tt) None of the Company's product candidates have received marketing approval from any Regulatory Authority.

(uu) Neither the Company nor any of its properties or assets has any immunity from the jurisdiction of any court or from any legal process (whether through service or notice, attachment prior to judgment, attachment in aid of execution or otherwise) under the laws of the State of New York.

(vv) At the time the Registration Statement was originally declared effective, and at the time the Company's most recent Annual Report on Form 10-K was filed with the Commission following the effectiveness of the Registration Statement, the Company met the then applicable requirements for the use of Form S-3 under the Securities Act, including, but not limited to, General Instruction I.B.1 or General Instruction I.B.6 of Form S-3. The Company satisfies the pre-1992 eligibility requirements for the use of a registration statement on Form S-3 in connection with this offering (the pre-1992 eligibility requirements for the use of the registration statement on Form S-3 include (i) having a non-affiliate, public common equity float of at least \$150 million or a non-affiliate, public common equity float of at least \$100 million and annual trading volume of at least three million shares and (ii) having been subject to the Exchange Act reporting requirements for a period of 36 months).

(ww) The Company is subject to and in compliance in all material respects with the reporting requirements of Section 13 or Section 15(d) of the Exchange Act. The Common Stock is registered pursuant to Section 12(b) or Section 12(g) of the Exchange Act and is listed on Nasdaq, and the Company has taken no action designed to, or reasonably likely to have the effect of, terminating the registration of the Common Stock under the Exchange Act or delisting the Common Stock from Nasdaq, nor has the Company received any written notification that the Commission or Nasdaq is contemplating terminating such registration or listing.

(xx) The interactive data in eXtensible Business Reporting Language included or incorporated by reference in the Registration Statement fairly presents the information called for in all material respects and has been prepared in accordance with the Commission's rules and guidelines applicable thereto.

(yy) Except for Cowen, there is no broker, finder or other party that is entitled to receive from the Company any brokerage or finder's fee or other fee or commission as a result of any transactions contemplated by this Agreement.

Any certificate signed by an officer of the Company and delivered to Cowen or to counsel for Cowen shall be deemed to be a representation and warranty by the Company to Cowen as to the matters set forth therein.

The Company acknowledges that Cowen and, for purposes of the opinions to be delivered pursuant to Section 7 hereof, counsel to the Company and counsel to Cowen, will rely upon the accuracy and truthfulness of the foregoing representations and hereby consents to such reliance.

7. Covenants of the Company. The Company covenants and agrees with Cowen that:

(a) Registration Statement Amendments. After the date of this Agreement and during any period in which a Prospectus relating to any Placement Shares is required to be delivered by Cowen under the Securities Act (including in circumstances where such requirement may be

satisfied pursuant to Rule 172 under the Securities Act or similar rule), (i) the Company will notify Cowen promptly of the time when any subsequent amendment to the Registration Statement, other than documents incorporated by reference, has been filed with the Commission and/or has become effective or any subsequent supplement to the Prospectus, other than documents incorporated by reference, has been filed and of any request by the Commission for any amendment or supplement to the Registration Statement or Prospectus or for additional information, (ii) the Company will prepare and file with the Commission, promptly upon Cowen's request, any amendments or supplements to the Registration Statement or Prospectus that, in Cowen's reasonable opinion, may be necessary or advisable in connection with the distribution of the Placement Shares by Cowen (*provided, however*, that the failure of Cowen to make such request shall not relieve the Company of any obligation or liability hereunder, or affect Cowen's right to rely on the representations and warranties made by the Company in this Agreement), (iii) the Company will not file any amendment or supplement to the Registration Statement or Prospectus, other than documents incorporated by reference, relating to the Placement Shares or a security convertible into the Placement Shares unless a copy thereof has been submitted to Cowen within a reasonable period of time before the filing and Cowen has not reasonably objected thereto (*provided, however*, that the failure of Cowen to make such objection shall not relieve the Company of any obligation or liability hereunder, or affect Cowen's right to rely on the representations and warranties made by the Company in this Agreement and *provided further* that the only remedy Cowen shall have with respect to the failure by the Company to obtain such consent shall be to cease making sales under this Agreement) and the Company will furnish to Cowen at the time of filing thereof a copy of any document that upon filing is deemed to be incorporated by reference into the Registration Statement or Prospectus, except for those documents available via EDGAR, (iv) the Company will cause each amendment or supplement to the Prospectus, other than documents incorporated by reference, to be filed with the Commission as required pursuant to the applicable paragraph of Rule 424(b) of the Securities Act, and (v) prior to the termination of this Agreement, the Company will notify Cowen if at any time the Registration Statement shall no longer be effective as a result of the passage of time pursuant to Rule 415 under the Securities Act or otherwise. Prior to the initial sale of any Placement Shares, the Company shall file a Final Sales Agreement Prospectus pursuant to Rule 424(b) relating to the Placement Shares.

(b) Notice of Commission Stop Orders. The Company will advise Cowen, promptly after it receives notice or obtains knowledge thereof, of the issuance or threatened issuance by the Commission of any stop order suspending the effectiveness of the Registration Statement, of the suspension of the qualification of the Placement Shares for offering or sale in any jurisdiction, or of the initiation or threatening of any proceeding for any such purpose; and it will promptly use its commercially reasonable efforts to prevent the issuance of any stop order or to obtain its withdrawal if such a stop order should be issued.

(c) Delivery of Prospectus: Subsequent Changes. During any period in which a Prospectus relating to the Placement Shares is required to be delivered by Cowen under the Securities Act with respect to a pending sale of the Placement Shares, (including in circumstances where such requirement may be satisfied pursuant to Rule 172 under the Securities Act or similar rule), the Company will comply with all requirements imposed upon it by the Securities Act, as from time to time in force, and to file on or before their respective due dates (taking into account any extensions available under the Exchange Act) all reports and any

definitive proxy or information statements required to be filed by the Company with the Commission pursuant to Sections 13(a), 13(c), 14, 15(d) or any other provision of or under the Exchange Act. If during such period any event occurs as a result of which the Prospectus as then amended or supplemented would include an untrue statement of a material fact or omit to state a material fact necessary to make the statements therein, in the light of the circumstances then existing, not misleading, or if during such period it is necessary to amend or supplement the Registration Statement or Prospectus to comply with the Securities Act, the Company will promptly notify Cowen to suspend the offering of Placement Shares during such period and the Company will promptly amend or supplement the Registration Statement or Prospectus (at the expense of the Company) so as to correct such statement or omission or effect such compliance; *provided, however*, that the Company may delay the filing of any amendment or supplement, if in the judgement of the Company, it is in the best interest of the Company to do so.

(d) Listing of Placement Shares. During any period in which the Prospectus relating to the Placement Shares is required to be delivered by Cowen under the Securities Act with respect to a pending sale of the Placement Shares (including in circumstances where such requirement may be satisfied pursuant to Rule 172 under the Securities Act or similar rule), the Company will use its commercially reasonable efforts to cause the Placement Shares to be listed on Nasdaq and to qualify the Placement Shares for sale under the securities laws of such jurisdictions in the United States as Cowen reasonably designates and to continue such qualifications in effect so long as required for the distribution of the Placement Shares; *provided, however*, that the Company shall not be required in connection therewith to qualify as a foreign corporation or dealer in securities or file a general consent to service of process in any jurisdiction.

(e) Delivery of Registration Statement and Prospectus. The Company will furnish to Cowen and its counsel (at the expense of the Company) copies of the Registration Statement, the Prospectus (including all documents incorporated by reference therein) and all amendments and supplements to the Registration Statement or Prospectus that are filed with the Commission during any period in which a Prospectus relating to the Placement Shares is required to be delivered under the Securities Act (including all documents filed with the Commission during such period that are deemed to be incorporated by reference therein), in each case as soon as reasonably practicable and in such quantities as Cowen may from time to time reasonably request and, at Cowen's request, will also furnish copies of the Prospectus to each exchange or market on which sales of the Placement Shares may be made; *provided, however*, that the Company shall not be required to furnish any document (other than the Prospectus) to Cowen to the extent such document is available on EDGAR.

(f) Earnings Statement. The Company will make generally available to its security holders as soon as practicable, but in any event not later than 15 months after the end of the Company's current fiscal quarter, an earnings statement covering a 12-month period that satisfies the provisions of Section 11(a) and Rule 158 of the Securities Act.

(g) Expenses. The Company, whether or not the transactions contemplated hereunder are consummated or this Agreement is terminated, in accordance with the provisions of Section 11 hereunder, will pay the following expenses all incident to the performance of its obligations hereunder, including, but not limited to, expenses relating to (i) the preparation, printing and filing of the Registration Statement and each amendment and supplement thereto, of each

Prospectus and of each amendment and supplement thereto, (ii) the preparation, issuance and delivery of the Placement Shares, (iii) the qualification of the Placement Shares under securities laws in accordance with the provisions of Section 7(d) of this Agreement, including filing fees (provided, however, that any fees or disbursements of counsel for Cowen in connection therewith shall be paid by Cowen except as set forth in (vii) below), (iv) the printing and delivery to Cowen of copies of the Prospectus and any amendments or supplements thereto, and of this Agreement, (v) the fees and expenses incurred in connection with the listing or qualification of the Placement Shares for trading on Nasdaq, (vi) the filing fees and expenses, if any, of the Commission, (vii) the filing fees and associated legal expenses of Cowen's outside counsel for filings with the FINRA Corporate Financing Department, such legal expense reimbursement not to exceed \$15,000, and (viii) the reasonable fees and disbursements of Cowen's counsel in an amount not to exceed \$50,000.

(h) Use of Proceeds. The Company will use the Net Proceeds as described in the Prospectus in the section entitled "Use of Proceeds."

(i) Notice of Other Sales. During the pendency of any Placement Notice given hereunder, and for five (5) trading days following the termination of any Placement Notice given hereunder, the Company shall provide Cowen notice as promptly as reasonably possible before it offers to sell, contracts to sell, sells, grants any option to sell or otherwise disposes of any shares of Common Stock (other than Placement Shares offered pursuant to the provisions of this Agreement) or securities convertible into or exchangeable for Common Stock, warrants or any rights to purchase or acquire Common Stock; *provided*, that such notice shall not be required in connection with the (i) issuance, grant or sale of Common Stock, options to purchase shares of Common Stock or Common Stock issuable upon the exercise of options or other equity awards pursuant to the any stock option, stock bonus or other stock plan or arrangement described in the Prospectus, (ii) the issuance of securities in connection with an acquisition, merger or sale or purchase of assets, (iii) the issuance or sale of Common Stock pursuant to any dividend reinvestment plan that the Company may adopt from time to time provided the implementation of such is disclosed to Cowen in advance, (iv) the issuance of any shares of Common Stock issuable upon the exchange, conversion or redemption of securities or the exercise of warrants, options or other rights in effect or outstanding or disclosed in filings by the Company available on EDGAR or otherwise in writing to Cowen prior to the date of the applicable Placement Notice or (v) the issuance or sale of Common Stock, or securities convertible into or exercisable for Common Stock, offered and sold in a privately negotiated transaction to vendors, customers, strategic partners or potential strategic partners conducted in a manner so as not to be integrated with the offering of Common Stock hereby. Notwithstanding the foregoing provisions, nothing herein shall be construed to restrict the Company's ability, or require the Company to provide notice to Cowen, to file a registration statement under the Securities Act.

(j) Change of Circumstances. The Company will, at any time during a fiscal quarter in which the Company intends to tender a Placement Notice or sell Placement Shares, advise Cowen promptly after it shall have received notice or obtained knowledge thereof, of any information or fact that would alter or affect in any material respect any opinion, certificate, letter or other document provided to Cowen pursuant to this Agreement.

(k) Due Diligence Cooperation. The Company will cooperate with any reasonable due diligence review conducted by Cowen or its agents in connection with the transactions

contemplated hereby, including, without limitation, providing information and making available documents and senior corporate officers, during regular business hours and at the Company's principal offices, as Cowen may reasonably request.

(l) **Required Filings Relating to Placement of Placement Shares.** The Company agrees that on such dates as the Securities Act shall require, the Company will (i) file a prospectus supplement with the Commission under the applicable paragraph of Rule 424(b) under the Securities Act, which prospectus supplement will set forth, within the relevant period, the amount of Placement Shares sold through Cowen, the Net Proceeds to the Company and the compensation payable by the Company to Cowen with respect to such Placement Shares, and (ii) deliver such number of copies of each such prospectus supplement to each exchange or market on which such sales were effected as may be required by the rules or regulations of such exchange or market.

(m) **Representation Dates; Certificate.** On or prior to the First Delivery Date and each time the Company (i) files the Prospectus relating to the Placement Shares or amends or supplements the Registration Statement or the Prospectus relating to the Placement Shares (other than a prospectus supplement filed in accordance with Section 7(l) of this Agreement) by means of a post-effective amendment, sticker, or supplement but not by means of incorporation of document(s) by reference to the Registration Statement or the Prospectus relating to the Placement Shares; (ii) files an annual report on Form 10-K under the Exchange Act; (iii) files its quarterly reports on Form 10-Q under the Exchange Act; or (iv) files a report on Form 8-K containing amended financial information (other than an earnings release) under the Exchange Act (each date of filing of one or more of the documents referred to in clauses (i) through (iv) shall be a "**Representation Date**"); the Company shall furnish Cowen with a certificate, in the form attached hereto as Exhibit 7(m) within three (3) Trading Days after any Representation Date if requested by Cowen. The requirement to provide a certificate under this Section 7(m) shall be waived for any Representation Date occurring at a time at which no Placement Notice is pending, which waiver shall continue until the earlier to occur of the date the Company delivers a Placement Notice hereunder (which for such calendar quarter shall be considered a Representation Date) and the next occurring Representation Date; *provided, however*, that such waiver shall not apply for any Representation Date on which the Company files its annual report on Form 10-K. Notwithstanding the foregoing, if the Company subsequently decides to sell Placement Shares following a Representation Date when the Company relied on such waiver and did not provide Cowen with a certificate under this Section 7(m), then before the Company delivers the Placement Notice or Cowen sells any Placement Shares, the Company shall provide Cowen with a certificate, in the form attached hereto as Exhibit 7(m), dated the date of the Placement Notice.

(n) **Legal Opinion.** On or prior to the First Delivery Date and within three (3) Trading Days of each Representation Date with respect to which the Company is obligated to deliver a certificate in the form attached hereto as Exhibit 7(m) for which no waiver is applicable, the Company shall cause to be furnished to Cowen a written opinion of Wilmer Cutler Pickering Hale and Dorr LLP ("**Company Counsel**") or other counsel satisfactory to Cowen, in form and substance satisfactory to Cowen and its counsel, dated the date that the opinion is required to be delivered, substantially similar to the form attached hereto as Exhibit 7(n), modified, as necessary, to relate to the Registration Statement and the Prospectus as then amended or

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supplemented; *provided* that the Company shall be required to furnish to Cowen no more than one opinion hereunder per calendar quarter; *provided, further*, that in lieu of such opinion for subsequent Representation Dates, counsel may furnish Cowen with a letter (a "**Reliance Letter**") to the effect that Cowen may rely on a prior opinion delivered under this Section 7(n) to the same extent as if it were dated the date of such letter (except that statements in such prior opinion shall be deemed to relate to the Registration Statement and the Prospectus as amended or supplemented at such Representation Date).

(o) **Comfort Letter.** On or prior to the First Delivery Date and within three (3) Trading Days after each Representation Date with respect to which the Company is obligated to deliver a certificate in the form attached hereto as Exhibit 7(m) for which no waiver is applicable, the Company shall cause its independent accountants to furnish Cowen letters (the "**Comfort Letters**"), dated the date the Comfort Letter is delivered, in form and substance reasonably satisfactory to Cowen, (i) confirming that they are an independent registered public accounting firm within the meaning of the Securities Act and the Public Company Accounting Oversight Board, (ii) stating, as of such date, the conclusions and findings of such firm with respect to the financial information and other matters ordinarily covered by accountants' "comfort letters" to Cowen in connection with registered public offerings (the first such letter, the "**Initial Comfort Letter**") and (iii) updating the Initial Comfort Letter with any information that would have been included in the Initial Comfort Letter had it been given on such date and modified as necessary to relate to the Registration Statement and the Prospectus, as amended and supplemented to the date of such letter; *provided* that the Company shall be required to furnish to Cowen no more than one Comfort Letter hereunder per calendar quarter.

(p) **Market Activities.** The Company will not, directly or indirectly, (i) take any action designed to cause or result in, or that constitutes or might reasonably be expected to constitute, the stabilization or manipulation of the price of any security of the Company to facilitate the sale or resale of the Placement Shares or (ii) sell, bid for, or purchase the Common Stock to be issued and sold pursuant to this Agreement, or pay anyone any compensation for soliciting purchases of the Placement Shares other than Cowen; *provided, however*, that the Company may bid for and purchase shares of its common stock in accordance with Rule 10b-18 under the Exchange Act.

(q) **Insurance.** The Company and its subsidiaries shall maintain, or cause to be maintained, insurance in such amounts and covering such risks as is reasonable and customary for the business for which it is engaged.

(r) **Compliance with Laws.** The Company and each of its subsidiaries shall maintain, or cause to be maintained, all material environmental permits, licenses and other authorizations required by federal, state and local law in order to conduct their businesses as described in the Prospectus, and the Company and each of its subsidiaries shall conduct their businesses, or cause their businesses to be conducted, in substantial compliance with such permits, licenses and authorizations and with applicable environmental laws, except where the failure to maintain or be in compliance with such permits, licenses and authorizations could not reasonably be expected to result in a Material Adverse Effect.

(s) **Investment Company Act.** The Company will conduct its affairs in such a manner so as to reasonably ensure that neither it nor its subsidiaries will be or become, at any time prior

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to the termination of this Agreement, an “investment company,” as such term is defined in the Investment Company Act, assuming no change in the Commission’s current interpretation as to entities that are not considered an investment company.

(t) Securities Act and Exchange Act. The Company will use its best efforts to comply with all requirements imposed upon it by the Securities Act and the Exchange Act as from time to time in force, so far as necessary to permit the continuance of sales of, or dealings in, the Placement Shares as contemplated by the provisions hereof and the Prospectus.

(u) No Offer to Sell. Other than a free writing prospectus (as defined in Rule 405 under the Securities Act) approved in advance by the Company and Cowen in its capacity as principal or agent hereunder, neither Cowen nor the Company (including its agents and representatives, other than Cowen in its capacity as such) will make, use, prepare, authorize, approve or refer to any written communication (as defined in Rule 405 under the Securities Act), required to be filed with the Commission, that constitutes an offer to sell or solicitation of an offer to buy Placement Shares hereunder.

(v) Sarbanes-Oxley Act. The Company and its subsidiaries will use their best efforts to comply with all effective applicable provisions of the Sarbanes-Oxley Act.

8. Conditions to Cowen’s Obligations. The obligations of Cowen hereunder with respect to a Placement will be subject to the continuing accuracy and completeness of the representations and warranties made by the Company herein, to the due performance by the Company of its obligations hereunder, to the completion by Cowen of a due diligence review satisfactory to Cowen in its reasonable judgment, and to the continuing satisfaction (or waiver by Cowen in its sole discretion) of the following additional conditions:

(a) Registration Statement Effective. The Registration Statement shall be effective and shall be available for the sale of all Placement Shares contemplated to be issued by any Placement Notice.

(b) No Material Notices. None of the following events shall have occurred and be continuing: (i) receipt by the Company or any of its subsidiaries of any request for additional information from the Commission or any other federal or state governmental authority during the period of effectiveness of the Registration Statement, the response to which would require any post-effective amendments or supplements to the Registration Statement or the Prospectus; (ii) the issuance by the Commission or any other federal or state governmental authority of any stop order suspending the effectiveness of the Registration Statement or the initiation of any proceedings for that purpose; (iii) receipt by the Company of any notification with respect to the suspension of the qualification or exemption from qualification of any of the Placement Shares for sale in any jurisdiction or the initiation or threatening of any proceeding for such purpose; or (iv) the occurrence of any event that makes any material statement made in the Registration Statement or the Prospectus or any material document incorporated or deemed to be incorporated therein by reference untrue in any material respect or that requires the making of any changes in the Registration Statement, related Prospectus or such documents so that, in the case of the Registration Statement, it will not contain any materially untrue statement of a material fact or omit to state any material fact required to be stated therein or necessary to make the statements therein not misleading and, that in the case of the Prospectus, it will not contain any materially

untrue statement of a material fact or omit to state any material fact required to be stated therein or necessary to make the statements therein, in the light of the circumstances under which they were made, not misleading.

(c) No Misstatement or Material Omission. Cowen shall not have advised the Company that the Registration Statement or Prospectus, or any amendment or supplement thereto, contains an untrue statement of fact that in Cowen's reasonable opinion is material, or omits to state a fact that in Cowen's reasonable opinion is material and is required to be stated therein or is necessary to make the statements therein not misleading.

(d) Material Changes. Except as contemplated in the Prospectus, or disclosed in the Company's reports filed with the Commission, there shall not have been any material adverse change, on a consolidated basis, in the authorized capital stock of the Company or any Material Adverse Effect or any development that could reasonably be expected to result in a Material Adverse Effect, or any downgrading in or withdrawal of the rating assigned to any of the Company's securities (other than asset backed securities) by any rating organization or a public announcement by any rating organization that it has under surveillance or review its rating of any of the Company's securities (other than asset backed securities), the effect of which, in the case of any such action by a rating organization described above, in the reasonable judgment of Cowen (without relieving the Company of any obligation or liability it may otherwise have), is so material as to make it impracticable or inadvisable to proceed with the offering of the Placement Shares on the terms and in the manner contemplated in the Prospectus.

(e) Company Counsel Legal Opinion. Cowen shall have received the opinion of Company Counsel required to be delivered pursuant to Section 7(n), or Reliance Letter to the extent permitted pursuant to Section 7(n), on or before the date on which such delivery of such opinion is required pursuant to Section 7(n).

(f) Cowen Counsel Legal Opinion. Cowen shall have received from Cooley LLP, counsel for Cowen, such opinion or opinions, on or before the date on which the delivery of the Company Counsel legal opinion is required pursuant to Section 7(n), with respect to such matters as Cowen may reasonably require, and the Company shall have furnished to such counsel such documents as they request for enabling them to pass upon such matters.

(g) Comfort Letter. Cowen shall have received the Comfort Letter required to be delivered pursuant to Section 7(o) on or before the date on which such delivery of such Comfort Letter is required pursuant to Section 7(o).

(h) Representation Certificate. Cowen shall have received the certificate required to be delivered pursuant to Section 7(m) on or before the date on which delivery of such certificate is required pursuant to Section 7(m).

(i) Secretary's Certificate. On or prior to the First Delivery Date, Cowen shall have received a certificate, signed on behalf of the Company by its corporate Secretary, in form and substance reasonably satisfactory to Cowen and its counsel.

(j) No Suspension. Trading in the Common Stock shall not have been suspended on Nasdaq.

(k) Other Materials. On each date on which the Company is required to deliver a certificate pursuant to Section 7(m), the Company shall have furnished to Cowen such appropriate further information, certificates and documents as Cowen may have reasonably requested. All such opinions, certificates, letters and other documents shall have been in compliance with the provisions hereof. The Company will furnish Cowen with such conformed copies of such opinions, certificates, letters and other documents as Cowen shall have reasonably requested.

(l) Securities Act Filings Made. All filings with the Commission required by Rule 424 under the Securities Act to have been filed prior to the issuance of any Placement Notice hereunder shall have been made within the applicable time period prescribed for such filing by Rule 424.

(m) Approval for Listing. The Placement Shares shall either have been (i) approved for listing on Nasdaq, subject only to notice of issuance, or (ii) the Company shall have filed an application for listing of the Placement Shares on Nasdaq at, or prior to, the issuance of any Placement Notice and Nasdaq shall not have raised any objection to such application.

(n) No Termination Event. There shall not have occurred any event that would permit Cowen to terminate this Agreement pursuant to Section 11(a).

(o) FINRA. FINRA shall have raised no objection to the terms of this offering and the amount of compensation allowable or payable to Cowen as described in the Prospectus.

9. Indemnification and Contribution.

(a) Company Indemnification. The Company agrees to indemnify and hold harmless Cowen, the directors, officers, partners, employees and agents of Cowen and each person, if any, who (i) controls Cowen within the meaning of Section 15 of the Securities Act or Section 20 of the Exchange Act, or (ii) is controlled by or is under common control with Cowen from and against any and all losses, claims, liabilities, expenses and damages (including, but not limited to, any and all reasonable investigative, legal and other expenses incurred in connection with, and any and all amounts paid in settlement (in accordance with Section 9(c)) of, any action, suit or proceeding between any of the indemnified parties and any indemnifying parties or between any indemnified party and any third party, or otherwise, or any claim asserted), as and when incurred, to which Cowen, or any such person, may become subject under the Securities Act, the Exchange Act or other federal or state statutory law or regulation, at common law or otherwise, insofar as such losses, claims, liabilities, expenses or damages arise out of or are based, directly or indirectly, on (x) any untrue statement or alleged untrue statement of a material fact contained in the Registration Statement or the Prospectus or any amendment or supplement to the Registration Statement or the Prospectus or in any free writing prospectus or in any application or other document executed by or on behalf of the Company in connection with this Agreement or based on written information furnished by or on behalf of the Company filed in any jurisdiction in order to qualify the Placement Shares under the securities laws thereof or filed with the Commission or (y) the omission or alleged omission to state in any such document a material fact required to be stated in it or necessary to make the statements in it not misleading; *provided, however*, that this indemnity agreement shall not apply to the extent that such loss, claim, liability, expense or damage arises from the sale of the Placement Shares pursuant to this

Agreement and is caused directly or indirectly by an untrue statement or omission made in reliance upon and in conformity with the Agent's Information. This indemnity agreement will be in addition to any liability that the Company might otherwise have.

(b) Cowen Indemnification. Cowen agrees to indemnify and hold harmless the Company and its directors and each officer of the Company that signed the Registration Statement, and each person, if any, who (i) controls the Company within the meaning of Section 15 of the Securities Act or Section 20 of the Exchange Act or (ii) is controlled by or is under common control with the Company against any and all loss, liability, claim, damage and expense described in the indemnity contained in Section 9(a), as incurred, but only with respect to untrue statements or omissions, or alleged untrue statements or omissions, made in the Registration Statement (or any amendments thereto) or the Prospectus (or any amendment or supplement thereto) in reliance upon and in conformity with the Agent's Information.

(c) Procedure. Any party that proposes to assert the right to be indemnified under this Section 9 will, promptly after receipt of notice of commencement of any action against such party in respect of which a claim is to be made against an indemnifying party or parties under this Section 9, notify each such indemnifying party of the commencement of such action, enclosing a copy of all papers served, but the omission so to notify such indemnifying party will not relieve the indemnifying party from (i) any liability that it might have to any indemnified party otherwise than under this Section 9 and (ii) any liability that it may have to any indemnified party under the foregoing provision of this Section 9 unless, and only to the extent that, such omission results in the forfeiture of substantive rights or defenses by the indemnifying party. If any such action is brought against any indemnified party and it notifies the indemnifying party of its commencement, the indemnifying party will be entitled to participate in and, to the extent that it elects by delivering written notice to the indemnified party promptly after receiving notice of the commencement of the action from the indemnified party, jointly with any other indemnifying party similarly notified, to assume the defense of the action, with counsel reasonably satisfactory to the indemnified party, and after notice from the indemnifying party to the indemnified party of its election to assume the defense, the indemnifying party will not be liable to the indemnified party for any legal or other expenses except as provided below and except for the reasonable costs of investigation subsequently incurred by the indemnified party in connection with the defense. The indemnified party will have the right to employ its own counsel in any such action, but the fees, expenses and other charges of such counsel will be at the expense of such indemnified party unless (1) the employment of counsel by the indemnified party has been authorized in writing by the indemnifying party, (2) the indemnified party has reasonably concluded (based on advice of counsel) that there may be legal defenses available to it or other indemnified parties that are different from or in addition to those available to the indemnifying party, (3) a conflict or potential conflict exists (based on advice of counsel to the indemnified party) between the indemnified party and the indemnifying party (in which case the indemnifying party will not have the right to direct the defense of such action on behalf of the indemnified party) or (4) the indemnifying party has not in fact employed counsel to assume the defense of such action within a reasonable time after receiving notice of the commencement of the action, in each of which cases the reasonable fees, disbursements and other charges of counsel will be at the expense of the indemnifying party or parties. It is understood that the indemnifying party or parties shall not, in connection with any proceeding or related proceedings in the same jurisdiction, be liable for the reasonable fees, disbursements and other charges of

more than one separate firm admitted to practice in such jurisdiction at any one time for all such indemnified party or parties. All such fees, disbursements and other charges will be reimbursed by the indemnifying party promptly after the indemnifying party receives a written invoice relating to fees, disbursements and other charges in reasonable detail. An indemnifying party will not, in any event, be liable for any settlement of any action or claim effected without its written consent. No indemnifying party shall, without the prior written consent of each indemnified party, settle or compromise or consent to the entry of any judgment in any pending or threatened claim, action or proceeding relating to the matters contemplated by this Section 9 (whether or not any indemnified party is a party thereto), unless such settlement, compromise or consent includes an unconditional release of each indemnified party from all liability arising or that may arise out of such claim, action or proceeding.

(d) Contribution. In order to provide for just and equitable contribution in circumstances in which the indemnification provided for in the foregoing paragraphs of this Section 9 is applicable in accordance with its terms but for any reason is held to be unavailable from the Company or Cowen, the Company and Cowen will contribute to the total losses, claims, liabilities, expenses and damages (including any investigative, legal and other expenses reasonably incurred in connection with, and any amount paid in settlement of, any action, suit or proceeding or any claim asserted, but after deducting any contribution received by the Company from persons other than Cowen, such as persons who control the Company within the meaning of the Securities Act, officers of the Company who signed the Registration Statement and directors of the Company, who also may be liable for contribution) to which the Company and Cowen may be subject in such proportion as shall be appropriate to reflect the relative benefits received by the Company on the one hand and Cowen on the other. The relative benefits received by the Company on the one hand and Cowen on the other hand shall be deemed to be in the same proportion as the total Net Proceeds from the sale of the Placement Shares (before deducting expenses) received by the Company bear to the total compensation received by Cowen from the sale of Placement Shares on behalf of the Company. If, but only if, the allocation provided by the foregoing sentence is not permitted by applicable law, the allocation of contribution shall be made in such proportion as is appropriate to reflect not only the relative benefits referred to in the foregoing sentence but also the relative fault of the Company, on the one hand, and Cowen, on the other, with respect to the statements or omission that resulted in such loss, claim, liability, expense or damage, or action in respect thereof, as well as any other relevant equitable considerations with respect to such offering. Such relative fault shall be determined by reference to, among other things, whether the untrue or alleged untrue statement of a material fact or omission or alleged omission to state a material fact relates to information supplied by the Company or Cowen, the intent of the parties and their relative knowledge, access to information and opportunity to correct or prevent such statement or omission. The Company and Cowen agree that it would not be just and equitable if contributions pursuant to this Section 9(d) were to be determined by pro rata allocation or by any other method of allocation that does not take into account the equitable considerations referred to herein. The amount paid or payable by an indemnified party as a result of the loss, claim, liability, expense, or damage, or action in respect thereof, referred to above in this Section 9(d) shall be deemed to include, for the purpose of this Section 9(d), any legal or other expenses reasonably incurred by such indemnified party in connection with investigating or defending any such action or claim to the extent consistent with Section 9(c) hereof. Notwithstanding the foregoing provisions of this Section 9(d), Cowen shall not be required to contribute any amount in excess of the commissions received by it under this

Agreement and no person found guilty of fraudulent misrepresentation (within the meaning of Section 11(f) of the Securities Act) will be entitled to contribution from any person who was not guilty of such fraudulent misrepresentation. For purposes of this [Section 9\(d\)](#), any person who controls a party to this Agreement within the meaning of the Securities Act, and any officers, directors, partners, employees or agents of Cowen, will have the same rights to contribution as that party, and each director of the Company and each officer of the Company who signed the Registration Statement will have the same rights to contribution as the Company, subject in each case to the provisions hereof. Any party entitled to contribution, promptly after receipt of notice of commencement of any action against such party in respect of which a claim for contribution may be made under this [Section 9\(d\)](#), will notify any such party or parties from whom contribution may be sought, but the omission to so notify will not relieve that party or parties from whom contribution may be sought from any other obligation it or they may have under this [Section 9\(d\)](#) except to the extent that the failure to so notify such other party materially prejudiced the substantive rights or defenses of the party from whom contribution is sought. Except for a settlement entered into pursuant to the last sentence of [Section 9\(c\)](#) hereof, no party will be liable for contribution with respect to any action or claim settled without its written consent if such consent is required pursuant to [Section 9\(c\)](#) hereof.

10. [Representations and Agreements to Survive Delivery](#). The indemnity and contribution agreements contained in [Section 9](#) of this Agreement and all representations and warranties of the Company herein or in certificates delivered pursuant hereto shall survive, as of their respective dates, regardless of (i) any investigation made by or on behalf of Cowen, any controlling persons, or the Company (or any of their respective officers, directors or controlling persons), (ii) delivery and acceptance of the Placement Shares and payment therefor or (iii) any termination of this Agreement.

11. [Termination](#).

(a) Cowen shall have the right by giving notice as hereinafter specified at any time to terminate this Agreement if (i) any Material Adverse Effect, or any development that could reasonably be expected to result in a Material Adverse Effect has occurred that, in the reasonable judgment of Cowen, may materially impair the ability of Cowen to sell the Placement Shares hereunder; (ii) the Company shall have failed, refused or been unable to perform any agreement on its part to be performed hereunder; *provided, however*, in the case of any failure of the Company to deliver (or cause another person to deliver) any certification, opinion, or letter required under [Sections 7\(m\)](#), [7\(n\)](#) or [7\(o\)](#), Cowen's right to terminate shall not arise unless such failure to deliver (or cause to be delivered) continues for more than thirty (30) days from the date such delivery was required; (iii) any other condition of Cowen's obligations hereunder is not fulfilled; or (iv) any suspension or limitation of trading in the Placement Shares or in securities generally on Nasdaq shall have occurred. Any such termination shall be without liability of any party to any other party except that the provisions of [Section 7\(g\)](#) (Expenses), [Section 9](#) (Indemnification and Contribution), [Section 10](#) (Representations and Agreements to Survive Delivery), [Section 16](#) (Applicable Law; Consent to Jurisdiction) and [Section 17](#) (Waiver of Jury Trial) hereof shall remain in full force and effect notwithstanding such termination. If Cowen elects to terminate this Agreement as provided in this [Section 11\(a\)](#), Cowen shall provide the required notice as specified in [Section 12](#) (Notices).

(b) The Company shall have the right, by giving ten (10) days' notice as hereinafter specified to terminate this Agreement in its sole discretion at any time after the date of this Agreement. Any such termination shall be without liability of any party to any other party except that the provisions of Section 7(g), Section 9, Section 10, Section 16 and Section 17 hereof shall remain in full force and effect notwithstanding such termination.

(c) Cowen shall have the right, by giving ten (10) days' notice as hereinafter specified to terminate this Agreement in its sole discretion at any time after the date of this Agreement. Any such termination shall be without liability of any party to any other party except that the provisions of Section 7(g), Section 9, Section 10, Section 16 and Section 17 hereof shall remain in full force and effect notwithstanding such termination.

(d) Unless earlier terminated pursuant to this Section 11, this Agreement shall automatically terminate upon the issuance and sale of all of the Placement Shares through Cowen on the terms and subject to the conditions set forth herein; *provided* that the provisions of Section 7(g), Section 9, Section 10, Section 16 and Section 17 hereof shall remain in full force and effect notwithstanding such termination.

(e) This Agreement shall remain in full force and effect unless terminated pursuant to Sections 11(a), (b), (c), or (d) above or otherwise by mutual agreement of the parties; *provided, however*, that any such termination by mutual agreement shall in all cases be deemed to provide that Section 7(g), Section 9, Section 10, Section 16 and Section 17 shall remain in full force and effect.

(f) Any termination of this Agreement shall be effective on the date specified in such notice of termination; *provided, however*, that such termination shall not be effective until the close of business on the date of receipt of such notice by Cowen or the Company, as the case may be. If such termination shall occur prior to the Settlement Date for any sale of Placement Shares, such Placement Shares shall settle in accordance with the provisions of this Agreement.

12. Notices. All notices or other communications required or permitted to be given by any party to any other party pursuant to the terms of this Agreement shall be in writing, unless otherwise specified in this Agreement, and if sent to Cowen, shall be delivered to Cowen at Cowen and Company, LLC, 599 Lexington Avenue, New York, NY 10022, fax no. (646) 562-1124, Attention: General Counsel, with a copy to Cooley LLP, 1114 Avenue of the Americas, New York, New York 10036, fax no. (212) 479-6275, Attention: Daniel I. Goldberg; or if sent to the Company, shall be delivered to Catabasis Pharmaceuticals, Inc., One Kendall Square, Building 1400E, Suite B14202, Cambridge, Massachusetts, 02139, fax no. (617) 273-2637, Attention: President, with a copy to Wilmer Cutler Pickering Hale and Dorr LLP, 60 State Street, Boston, Massachusetts 02109, fax no. (617) 526-5000, Attention: Rosemary G. Reilly. Each party to this Agreement may change such address for notices by sending to the parties to this Agreement written notice of a new address for such purpose. Each such notice or other communication shall be deemed given (i) when delivered personally or by verifiable facsimile transmission (with an original to follow) on or before 4:30 p.m., New York City time, on a Business Day (as defined below), or, if such day is not a Business Day on the next succeeding Business Day, (ii) on the next Business Day after timely delivery to a nationally-recognized overnight courier and (iii) on the Business Day actually received if deposited in the U.S. mail (certified or registered mail, return receipt requested, postage prepaid). For purposes of this Agreement, "**Business Day**" shall

mean any day on which Nasdaq and commercial banks in the City of New York are open for business.

13. Successors and Assigns. This Agreement shall inure to the benefit of and be binding upon the Company and Cowen and their respective successors and the affiliates, controlling persons, officers and directors referred to in Section 9 hereof. References to any of the parties contained in this Agreement shall be deemed to include the successors and permitted assigns of such party. Nothing in this Agreement, express or implied, is intended to confer upon any party other than the parties hereto or their respective successors and permitted assigns any rights, remedies, obligations or liabilities under or by reason of this Agreement, except as expressly provided in this Agreement. Neither party may assign its rights or obligations under this Agreement without the prior written consent of the other party; *provided, however*, that Cowen may assign its rights and obligations hereunder to an affiliate of Cowen without obtaining the Company's consent, so long as such affiliate is a registered broker-dealer.

14. Adjustments for Share Splits. The parties acknowledge and agree that all share-related numbers contained in this Agreement shall be adjusted to take into account any share split, share dividend or similar event effected with respect to the Common Stock.

15. Entire Agreement; Amendment; Severability. This Agreement (including all schedules and exhibits attached hereto and Placement Notices issued pursuant hereto) constitutes the entire agreement and supersedes all other prior and contemporaneous agreements and undertakings, both written and oral, among the parties hereto with regard to the subject matter hereof. Neither this Agreement nor any term hereof may be amended except pursuant to a written instrument executed by the Company and Cowen. In the event that any one or more of the provisions contained herein, or the application thereof in any circumstance, is held invalid, illegal or unenforceable as written by a court of competent jurisdiction, then such provision shall be given full force and effect to the fullest possible extent that it is valid, legal and enforceable, and the remainder of the terms and provisions herein shall be construed as if such invalid, illegal or unenforceable term or provision was not contained herein, but only to the extent that giving effect to such provision and the remainder of the terms and provisions hereof shall be in accordance with the intent of the parties as reflected in this Agreement.

16. Applicable Law; Consent to Jurisdiction. This Agreement shall be governed by, and construed in accordance with, the internal laws of the State of New York without regard to the principles of conflicts of laws. Each party hereby irrevocably submits to the non-exclusive jurisdiction of the state and federal courts sitting in the City of New York, borough of Manhattan, for the adjudication of any dispute hereunder or in connection with any transaction contemplated hereby, and hereby irrevocably waives, and agrees not to assert in any suit, action or proceeding, any claim that it is not personally subject to the jurisdiction of any such court, that such suit, action or proceeding is brought in an inconvenient forum or that the venue of such suit, action or proceeding is improper. Each party hereby irrevocably waives personal service of process and consents to process being served in any such suit, action or proceeding by mailing a copy thereof (certified or registered mail, return receipt requested) to such party at the address in effect for notices to it under this Agreement and agrees that such service shall constitute good and sufficient service of process and notice thereof. Nothing contained herein shall be deemed to limit in any way any right to serve process in any manner permitted by law.

17. Waiver of Jury Trial. The Company and Cowen each hereby irrevocably waives any right it may have to a trial by jury in respect of any claim based upon or arising out of this Agreement or any transaction contemplated hereby.

18. Absence of Fiduciary Relationship. The Company acknowledges and agrees that:

(a) Cowen has been retained solely to act as sales agent in connection with the sale of the Common Stock and that no fiduciary, advisory or agency relationship between the Company and Cowen has been created in respect of any of the transactions contemplated by this Agreement, irrespective of whether Cowen has advised or is advising the Company on other matters;

(b) the Company is capable of evaluating and understanding and understands and accepts the terms, risks and conditions of the transactions contemplated by this Agreement;

(c) the Company has been advised that Cowen and its affiliates are engaged in a broad range of transactions which may involve interests that differ from those of the Company and that Cowen has no obligation to disclose such interests and transactions to the Company by virtue of any fiduciary, advisory or agency relationship; and

(d) the Company waives, to the fullest extent permitted by law, any claims it may have against Cowen, for breach of fiduciary duty or alleged breach of fiduciary duty and agrees that Cowen shall have no liability (whether direct or indirect) to the Company in respect of such a fiduciary claim or to any person asserting a fiduciary duty claim on behalf of or in right of the Company, including stockholders, partners, employees or creditors of the Company.

19. Counterparts. This Agreement may be executed in two or more counterparts, each of which shall be deemed an original, but all of which together shall constitute one and the same instrument. Delivery of an executed Agreement by one party to the other may be made by facsimile or electronic transmission.

20. Definitions. As used in this Agreement, the following term has the meaning set forth below:

(a) “*Applicable Time*” means the date of this Agreement, each Representation Date, the date on which a Placement Notice is given, and any date on which Placement Shares are sold hereunder.

(b) “*Agent’s Information*” means, solely the following information in the Prospectus: the last sentence of the eighth paragraph and the tenth paragraph under the caption “Plan of Distribution” in the Prospectus.

[Remainder of Page Intentionally Blank]

If the foregoing correctly sets forth the understanding between the Company and Cowen, please so indicate in the space provided below for that purpose, whereupon this letter shall constitute a binding agreement between the Company and Cowen.

Very truly yours,

COWEN AND COMPANY, LLC

By: /s/ E. James Streator, III
Name: E. James Streator, III
Title: Managing Director

**ACCEPTED as of the date
first-above written:**

CATABASIS PHARMACEUTICALS, INC.

By: /s/ Jill C. Milne
Name: Jill C. Milne
Title: President and Chief Executive Officer

FORM OF PLACEMENT NOTICE

From: [•]
Cc: [•]
To: [•]
Date: [•], 201[9]
Subject: Cowen and Company, LLC — At the Market Offering — Placement Notice

Ladies and Gentlemen:

Pursuant to the terms and subject to the conditions contained in the Sales Agreement between Catabasis Pharmaceuticals, Inc. (the “Company”) and Cowen and Company, LLC (“Cowen”) dated May 14, 2019, I hereby request on behalf of the Company that Cowen sell up to [•] shares of the Company’s common stock, par value \$0.001 per share, at a minimum market price of \$[•] per share. Sales should begin on the date of this Notice and shall continue until [date] [all shares are sold].

The Company

Jill C. Milne, President and Chief Executive Officer

Deirdre A. Cunnane, Chief Legal Officer

Cowen and Company, LLC

Michael Murphy, Director

William Follis, Managing Director

Compensation

Cowen shall be paid compensation equal to 3.0% of the gross proceeds from the sales of Common Stock pursuant to the terms of this Agreement.

May 14, 2019

Catabasis Pharmaceuticals, Inc.
One Kendall Square
Building 1400E, Suite B14202
Cambridge, Massachusetts 02139

Re: Registration Statement on Form S-3

Ladies and Gentlemen:

This opinion is furnished to you in connection with a Registration Statement on Form S-3 (the "Registration Statement") filed by Catabasis Pharmaceuticals, Inc., a Delaware corporation (the "Company"), with the Securities and Exchange Commission (the "Commission") under the Securities Act of 1933, as amended (the "Securities Act"), for the registration of the following securities of the Company (the "Securities"):

- i. common stock, par value \$0.001 per share (the "Common Stock");
- ii. preferred stock, par value \$0.001 per share (the "Preferred Stock");
- iii. depositary shares representing an interest in a fractional share or multiple shares of Preferred Stock (the "Depositary Shares");
- iv. units consisting of any combination of Common Stock, Preferred Stock, Depositary Shares or Warrants (as defined below) (the "Units"); and
- v. warrants to purchase Common Stock, Preferred Stock or Depositary Shares (the "Warrants"),

all of which may be issued from time to time on a delayed or continuous basis pursuant to Rule 415 under the Securities Act at an aggregate offering price not to exceed \$250,000,000, as set forth in the Registration Statement, the base prospectus or warrant share prospectus contained therein (collectively, the "Prospectus") and any amendments or supplements thereto.

We are acting as counsel for the Company in connection with the filing of the Registration Statement. The preferences, limitations and relative rights of shares of any series of Preferred Stock will be set forth in a Certificate of Designation (a "Certificate of Designation") with respect thereto. The shares of Preferred Stock represented by Depositary Shares will be deposited pursuant to a Depositary Agreement (the "Depositary Agreement") between the Company and a bank or trust company as depositary, and the preferences, limitations and relative rights of such shares of Preferred Stock will be set forth in a Certificate of Designation with respect thereto. The Units may be issued pursuant to a Unit Agreement (the "Unit Agreement") between the Company and a bank or trust company as unit agent. The Warrants may be issued pursuant to a warrant agreement (the "Warrant Agreement") between the Company and a bank or trust company as warrant agent.

We have examined and relied upon signed copies of the Registration Statement as filed with the Commission, including the exhibits thereto. We have also examined and relied upon the Restated Certificate of Incorporation of the Company (as amended or restated from time to time, the "Certificate of Incorporation"), the Amended and Restated By-laws of the Company (as amended or restated from time to time, the "Bylaws") and minutes of

Wilmer Cutler Pickering Hale and Dorr LLP, 60 State Street, Boston, Massachusetts 02109

Beijing Berlin Boston Brussels Denver Frankfurt London Los Angeles New York Palo Alto Washington

meetings and consents of the stockholders and the Board of Directors of the Company as provided to us by the Company.

In our examination of the foregoing documents, we have assumed the genuineness of all signatures, the authenticity of all documents submitted to us as originals, the conformity to original documents of all documents submitted to us as copies, the authenticity of the originals of such latter documents and the legal capacity of all signatories to such documents.

We have relied as to certain matters on information obtained from public officials and officers of the Company, and we have assumed that (i) one or more prospectus supplements will have been prepared and filed with the Commission describing the Securities offered thereby; (ii) all Securities will be issued and sold in compliance with applicable federal and state securities laws and in the manner stated in the Registration Statement, the Prospectus and any applicable prospectus supplement; (iii) a definitive purchase, underwriting or similar agreement with respect to any Securities offered will be duly authorized, executed and delivered by all parties thereto other than the Company; (iv) any Securities issuable upon conversion, exchange or exercise of any Security being offered will be duly authorized, created and, if appropriate, reserved for issuance upon such conversion, exchange or exercise; (v) with respect to shares of Common Stock or Preferred Stock offered, there will be sufficient shares of Common Stock or Preferred Stock authorized under the Certificate of Incorporation and not otherwise reserved for issuance; and (vi) the Company will be validly existing as a corporation and in good standing under the laws of the State of Delaware.

We are expressing no opinion herein as to the application of any federal or state law or regulation to the power, authority or competence of any party to any agreement with respect to any of the Securities other than the Company. We have assumed that such agreements are, or will be, the valid and binding obligations of each party thereto other than the Company, and enforceable against each such other party in accordance with their respective terms.

We have assumed for purposes of our opinions below that no authorization, approval or other action by, and no notice to or filing with, any governmental authority or regulatory body or any other third party is required for the due execution, delivery or performance by the Company, or, if any such authorization, approval, consent, action, notice or filing is required, it will have been duly obtained, taken, given or made and will be in full force and effect. We have also assumed that the execution and delivery by the Company of the Depositary Agreement, the Unit Agreement and the Warrant Agreement and the Securities and the performance by the Company of its obligations thereunder do not and will not violate, conflict with or constitute a default under (i) any agreement or instrument to which the Company or any of its properties is then subject, (ii) any law, rule, or regulation to which the Company or any of its properties is then subject or (iii) any judicial or regulatory order or decree of any governmental authority.

We have also assumed that there will not have occurred, prior to the date of issuance of the Securities, any change in law affecting the validity or enforceability of such Securities and that at the time of the issuance and sale of the Securities, the Board of Directors of the Company (or any committee thereof acting pursuant to authority properly delegated to such committee by the Board of Directors of the Company) shall not have taken any action to rescind or otherwise reduce its prior authorization of the issuance of the Securities.

Our opinions below are qualified to the extent that they may be subject to or affected by (i) applicable bankruptcy, insolvency, reorganization, moratorium, usury, fraudulent conveyance or similar laws relating to or affecting the rights or remedies of creditors generally, (ii) duties and standards imposed on creditors and parties to contracts, including, without limitation, requirements of materiality, good faith, reasonableness and fair dealing and (iii) general equitable principles. Furthermore, we express no opinion as to the availability of any equitable or specific remedy upon any breach of any of the agreements as to which we are opining herein, or any of the agreements, documents or obligations referred to therein, or to the successful assertion of any equitable defenses, inasmuch as the availability of such remedies or the success of any equitable defenses may be subject to the discretion of a court. We express no opinion herein as to the laws of any state or jurisdiction other than the state laws of the Commonwealth of Massachusetts and the General Corporation Law of the State of Delaware. We also express no opinion herein with respect to compliance by the Company with the securities or "blue sky" laws of any state or other jurisdiction of the United States or of any foreign jurisdiction. In addition, we express no opinion and make no statement herein with respect to the antifraud or antitrust or unfair competition laws of any jurisdiction.

We also express no opinion herein as to any provision of any agreement (i) that may be deemed to or construed to waive any right of the Company, (ii) to the effect that rights and remedies are not exclusive, that every right or remedy is cumulative and may be exercised in addition to or with any other right or remedy and does not preclude recourse to one or more other rights or remedies, (iii) relating to the effect of invalidity or unenforceability of any provision of any agreement on the validity or enforceability of any other provision thereof, (iv) that is in violation of public policy, (v) relating to indemnification and contribution with respect to securities law matters, (vi) which provides that the terms of any agreement may not be waived or modified except in writing, (vii) purporting to indemnify any person against his, her or its own negligence or intentional misconduct, (viii) requiring the payment of penalties, consequential damages or liquidated damages or (ix) relating to choice of law or consent to jurisdiction.

Based upon and subject to the foregoing, we are of the opinion that:

1. With respect to the Common Stock, when (i) specifically authorized for issuance by proper action of the Company's Board of Directors or an authorized committee thereof ("Authorizing Resolutions"), (ii) the terms of the issuance and sale of the Common Stock have been duly established in conformity with the Certificate of Incorporation and Bylaws, (iii) the shares of Common Stock have been issued and delivered in accordance with the applicable underwriting or other purchase agreement against payment therefor, and (iv) the Company has received the consideration provided for in the Authorizing Resolutions and the applicable underwriting agreement or other purchase agreement and such consideration per share is not less than the par value per share of the Common Stock, the Common Stock will be validly issued, fully paid and non-assessable.
 2. With respect to shares of any series of Preferred Stock, when (i) Authorizing Resolutions have specifically authorized the issuance and terms of the shares of the series, the terms of the offering thereof and related matters, including resolutions establishing and designating the series and fixing and determining the preferences, limitations and relative rights thereof and the filing of a Certificate of Designation with respect to the series with the Secretary of State of the State of Delaware, and such Certificate of Designation has been duly filed, (ii) the terms of the issuance and sale of the series of Preferred Stock have been duly established in conformity with the Certificate of Incorporation and Bylaws, (iii) the shares of the series of Preferred Stock have been issued and delivered in accordance with the applicable underwriting or other purchase agreement against payment therefor, and (iv) the Company has received the consideration provided for in the Authorizing Resolutions and the applicable underwriting agreement or other purchase agreement and such consideration per share is not less than the par value per share of the Preferred Stock, the shares of such series of Preferred Stock will be validly issued, fully paid and non-assessable.
 3. With respect to the Depositary Shares, when (i) the Authorizing Resolutions have specifically authorized the issuance and terms of the Depositary Shares, the terms of the offering thereof and related matters, including the adoption of a Certificate of Designation relating to the Preferred Stock underlying the Depositary Shares and the filing of the Certificate of Designation with the Secretary of State of the State of Delaware, and such Certificate of Designation has been duly filed, (ii) the applicable Depositary Agreement relating to the Depositary Shares has been duly authorized, executed and delivered; any depositary receipts evidencing rights in the Depositary Shares have been executed; and the depositary appointed by the Company, (iii) the terms of the issuance and sale of the Depositary Shares have been duly established in conformity with the Certificate of Incorporation and By-laws, (iv) the Depositary Shares have been issued and sold as contemplated by the Registration Statement, the Prospectus and the applicable prospectus supplement, (v) the shares of Preferred Stock underlying the Depositary Shares have been deposited with a bank or trust company (which meets the requirements for the depositary set forth in the Registration Statement), and (vi) the Company has received the consideration provided for in the Authorizing Resolutions and the applicable underwriting agreement or other purchase agreement, the Depositary Shares will be legally issued and will entitle the holders of such Depositary Shares to the rights specified in the applicable Depositary Agreement and the applicable depositary receipts.
 4. With respect to the Units, when (i) specifically authorized for issuance by Authorizing Resolutions, (ii) the applicable Unit Agreement has been duly authorized, executed and delivered, (iii) the terms of the Units and of their issuance and sale have been duly established in conformity with the applicable Unit Agreement and the Authorizing Resolutions, (iv) the Units have been duly executed and delivered in accordance with
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the applicable Unit Agreement and issued and delivered in accordance with the applicable underwriting or other purchase agreement against payment therefor, and (v) the Company has received the consideration provided for in the Authorizing Resolutions and the applicable underwriting agreement or other purchase agreement, such Units will constitute valid and binding obligations of the Company enforceable against the Company in accordance with their terms.

5. With respect to the Warrants, when (i) specifically authorized for issuance by Authorizing Resolutions, (ii) the applicable Warrant Agreement relating to the Warrants has been duly authorized, executed and delivered, (iii) the terms of the Warrants and of their issuance and sale have been duly established in conformity with the applicable Warrant Agreement and the Authorizing Resolutions, (iv) the Warrants have been duly executed and countersigned in accordance with the applicable Warrant Agreement and issued and delivered in accordance with the applicable underwriting or other purchase agreement against payment therefor, and (v) the Company has received the consideration provided for in the Authorizing Resolutions and the applicable underwriting agreement or other purchase agreement, such Warrants will constitute valid and binding obligations of the Company enforceable against the Company in accordance with their terms.

Please note that we are opining only as to the matters expressly set forth herein, and no opinion should be inferred as to any other matters. This opinion is based upon currently existing statutes, rules, regulations and judicial decisions, and we disclaim any obligation to advise you of any change in any of these sources of law or subsequent legal or factual developments which might affect any matters or opinions set forth herein.

We hereby consent to the filing of this opinion with the Commission as an exhibit to the Registration Statement in accordance with the requirements of Item 601(b)(5) of Regulation S-K under the Securities Act and to the use of our name therein and in the related Prospectus and in any prospectus supplement under the caption "Legal Matters." In giving such consent, we do not hereby admit that we are in the category of persons whose consent is required under Section 7 of the Securities Act or the rules and regulations of the Commission.

Very truly yours,

WILMER CUTLER PICKERING HALE AND DORR LLP

By: /s/ Rosemary G. Reilly
Rosemary G. Reilly, a Partner

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Exhibit 23.1

Consent of Independent Registered Public Accounting Firm

We consent to the reference to our firm under the caption "Experts" in the Registration Statement (Form S-3) and related Prospectus of Catabasis Pharmaceuticals, Inc. for the registration of common stock, preferred stock, depository shares, units and warrants and to the incorporation by reference therein of our report dated March 14, 2019, with respect to the consolidated financial statements of Catabasis Pharmaceuticals, Inc. included in its Annual Report (Form 10-K) for the year ended December 31, 2018, filed with the Securities and Exchange Commission.

/s/ Ernst & Young LLP

Boston, Massachusetts
May 13, 2019

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[Consent of Independent Registered Public Accounting Firm](#)